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Part A Report

SECOND MAJOR AIRPORT SITING STUDY

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Massachusetts Aeronautics Commission

December 1990
Reprinted March 1991

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Executive Summary
Part A Report

SECOND MAJOR AIRPORT SITING STUDY

Massachusetts Aeronautics Commission

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December 1990

Reprinted March 1991

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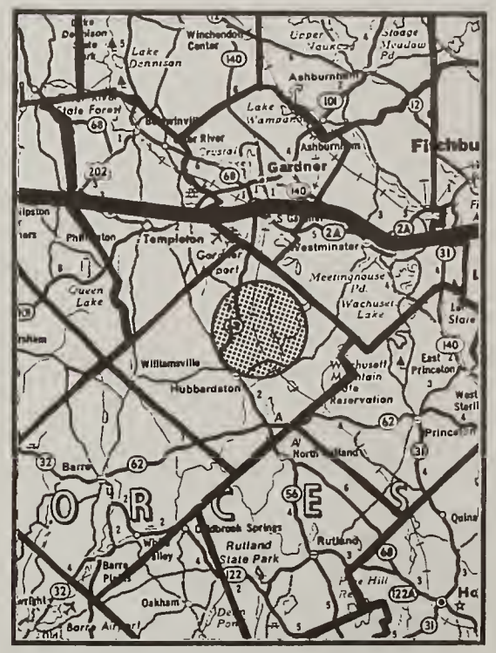
ADDENDUM

Change in Site Status

In January 1991 Site DD in Hubbardston was re-classified as the twelfth site in Category 1, and is thus being studied further in Part B of the Siting Study. The change in classification resulted from the identification of more relatively unconstrained land area than had been initially identified.

Figure A

Site DD
Hubbardston



* Contours shown at 10 foot intervals.

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SECOND MAJOR AIRPORT SITING STUDY

EXECUTIVE SUMMARY

Background

The Massachusetts Aeronautics Commission, in its 1989 Massachusetts Airport System Plan, recommended the initiation of a siting study for a second major airport. Present estimates suggest that even with planned operational and capacity improvements, Logan International Airport in combination with all of the other New England airports will not be able to accommodate all the air travel demand beyond approximately 2010.

As identified in the state plan, the Second Major Airport (SMA) would be a significant commercial airport to provide additional capacity for passenger and cargo service in the New England region. It would initially serve 5 to 7 million total passengers annually and process about 100,000 tons of air cargo. By the year 2020, it is projected to accommodate up to 30 million passengers and 200,000 tons of air cargo annually. The impact of a second major airport on the Massachusetts and New England economies would be significant. A 30 million passenger airport is estimated to generate 40,000 - 50,000 new jobs and have a total annual economic impact of 4 - 5 billion dollars.

The Massachusetts Aeronautics Commission study area is the Commonwealth of Massachusetts. Several factors have determined this basic study area:

- MAC is a state agency with jurisdiction only within Massachusetts.
- About 70 percent of the 2010 demand will be generated by Massachusetts residents and businesses.
- Because the travel demand is generated within Massachusetts it clearly makes sense that Massachusetts bear both the potential costs of such a facility, and also reap the significant economic benefits which such a facility would generate.

The Airport System Plan concluded that to meet the aviation needs of the next century, Massachusetts should begin to identify possible Second Major Airport sites and reserve the required land area. This would preserve the State's option to construct such a facility should the state and the region determine that such an action should be taken, and provide sufficient time for local communities to develop and implement growth management plans.

Study Participants

The sponsoring agency for the Second Major Airport Siting Study is the Massachusetts Aeronautics Commission (MAC). MAC has development and regulatory responsibility for all of the publicly licensed airports in Massachusetts (with the exception of Logan

International Airport and Hanscom Field). MAC falls under the jurisdiction of the Executive Office of Transportation and Construction.

The Federal Aviation Administration is providing 90% funding for the study and is participating in project review. The Massachusetts Port Authority provided initial seed money and grant matching funds for the project.

A Blue Ribbon Panel (BRP) of 52 members including representatives of the aviation community, corporations and business associations, academia, government, local communities, and experts in regional planning, land-use, and environmental concerns was appointed by MAC. Also included in the BRP are representatives of MAC's sister agencies from each of the New England states and the Federal Aviation Administration.

The Panel reviews and comments on the work presented by the project staff (including the work scope). To date the BRP has reached consensus on the site criteria, inventory of sites and the universe of sites. The BRP will continue to provide comment, and work to develop consensus on the short list of recommended sites. The Panel is chaired by Representative Stephen Karol (Chair, House Committee on Transportation) and MAC Commissioner Pamela Wolfe. A list of all Panel members is provided in the Report.

In addition to the participation of the Blue Ribbon Panel there has been an ongoing public outreach effort. The Commission held an introductory Public Information Meeting in October and plans to hold several more in January, and then again in April at the conclusion of the study. An extensive mailing list of public officials, interested citizens and the press is being maintained as part of the public outreach effort. The Interim and Final Reports and Public Information Brochure will be widely distributed. Briefings have been held with a number of local communities, public groups, and for the local and regional press. It is the intention of the MAC to carry out the study in the public eye, and to provide ample opportunity for public review and debate of both the study process and findings. While a number of airport siting studies have been previously prepared for Massachusetts, this is the first airport siting study carried out in a public and open process.

Project Description

The goals of the study are to identify sites in Massachusetts which may be suitable for a Second Major Airport, and to develop an Action Plan which identifies both the steps toward choosing a site and the tools which will provide the host community with the means to carry out growth management in response to the siting of such a major new facility.

The primary study tasks are as follows:

1. Preparation of airport models which describe the physical and operational characteristics of a Second Major Airport.

2. Development of site criteria to guide the evaluation of possible sites for a Second Major Airport.

3. Preparation of an inventory of sites which includes all those locations in the State which might possibly accommodate a Second Major Airport.

4. Screening of all of the sites identified to develop a recommended short list of sites which are potentially suitable for a Second Major Airport.

5. Development of an outline of future planning actions and considerations necessary to select the final site, and to provide host communities with the tools necessary to carry out growth management.

Study Process

The study is divided into two parts. Part A, which is summarized in this Report, prepared the airport models which were used to evaluate possible sites, established the site criteria and range of issues important to evaluating sites, prepared an inventory of all possible sites, and undertook the first level of analysis. This analysis has identified a universe of sites which will be further scrutinized during Part B of the Study.

Part B, which will be carried out from December 1990 through April 1991, will examine the universe of sites in greater detail and result in a short list of sites that may be suitable for a Second Major Airport. The work of Part B will eliminate those sites included in the universe of sites which do not adequately satisfy the criteria established during Part A. Part B will establish a short list of sites which are potentially suitable for a Second Major Airport, and are thus recommended for further study in future phases of work.

A series of detailed site profiles will be prepared for those sites selected for the short list. The site profiles will include the following: a comprehensive description of site conditions, noise impact contours, land use compatibility, passenger and cargo market areas, and economic impacts; a diagrammatic airport layout for each site showing runway configuration, ground access and areas for terminal, cargo and support facilities; an estimate of capital costs for each site based on land cost, infrastructure cost, airport site and building cost, and off-site roadway costs; a preliminary finance strategy including financing options, consideration of potential federal funding, and identification of key finance strategy issues.

In addition, an Action Plan will be developed which identifies the institutional, environmental, political, and design/construction actions needed to select a Second

Major Airport site and to guide future growth and change at the local, regional and State level.

A final report and an information brochure outlining the study and its findings and recommendations will be available for public distribution in April 1991.

Part **A Key Study Findings**

- 182 possible locations for a SMA were identified during the initial site search (see Figure 1).

- Site constraints were identified and used to evaluate possible locations. These constraints were: severely restricted air space; areas of dense residential and commercial development; major water bodies and wetlands; and areas of severe topography.

- 32 locations faced none of these constraints and were thus selected as the inventory of sites worthy of further investigation (see Figure 1).

- Site criteria were developed to evaluate the 32 locations for their potential merit as SMA sites. These are: airfield capacity; aircraft operations; market capture; noise impacts on residential areas; impacts on state or federal protected park, recreation or conservation areas; and core parcel size.

- Following evaluation of the 32 locations on the basis of the site criteria, four groups of sites with distinct characteristics emerged (See Figure 2). These are:

  1. Those sites which had reasonable characteristics with respect to all of the site criteria (11 locations).

  1A. Those sites which had reasonable characteristics with respect to all of the site criteria, with the exception that they would require the use of very large areas of parkland (4 locations).

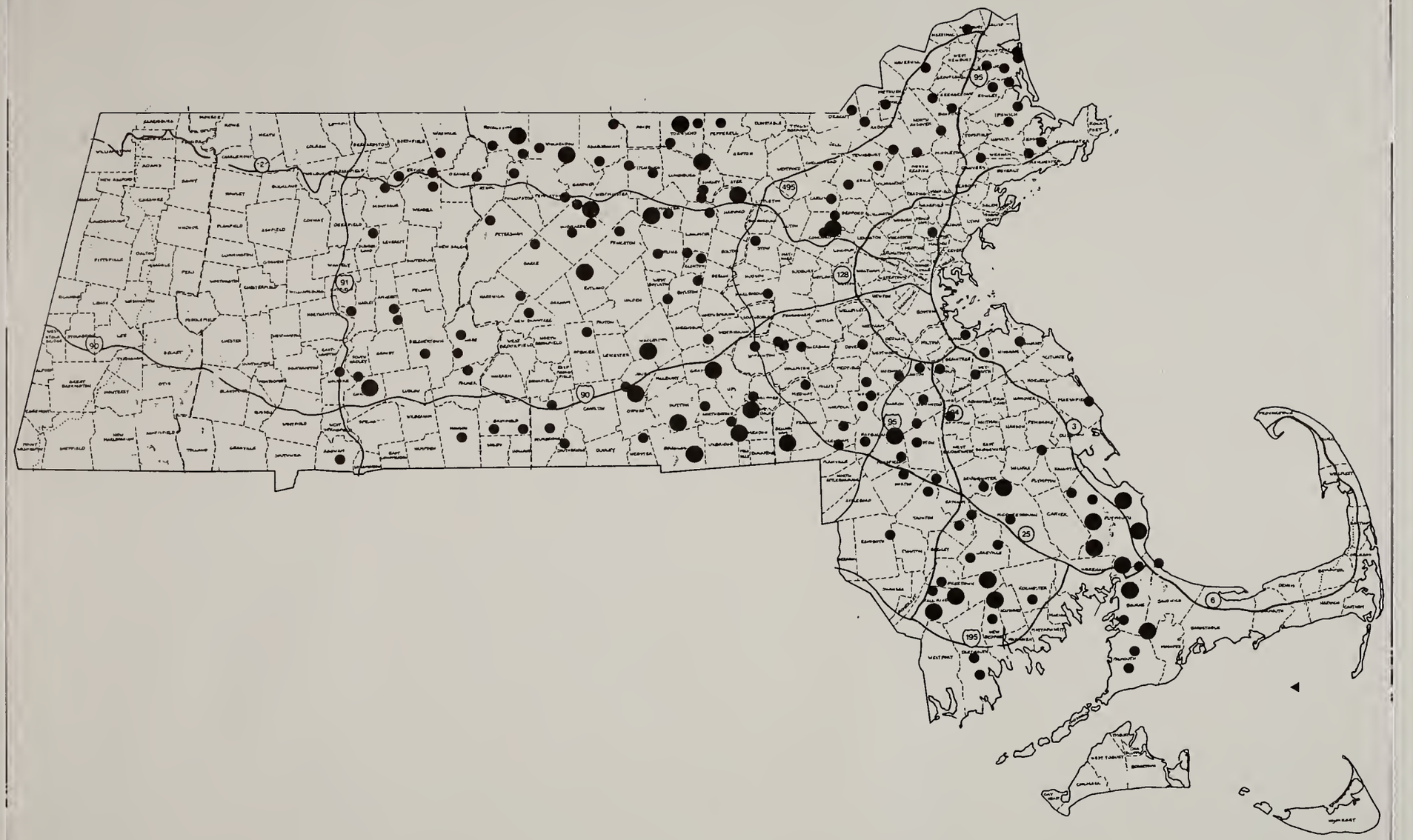
  2. Those sites which did not meet a number of site criteria very well, in particular were likely to result in significant noise impacts to existing communities (5 locations).

  3. Those sites which could not accommodate more than one 10,000 foot runway, and could thus not meet the airfield capacity needs of a Second Major Airport (12 locations).

- Further site criteria were developed to evaluate the universe of sites and identify a short list of potential SMA sites. These are; aeronautical features; cost; economic

Figure 1

All Sites Reviewed for the Study



● Inventory Sites
• Other sites

Note: All locations are approximate

0 20 miles

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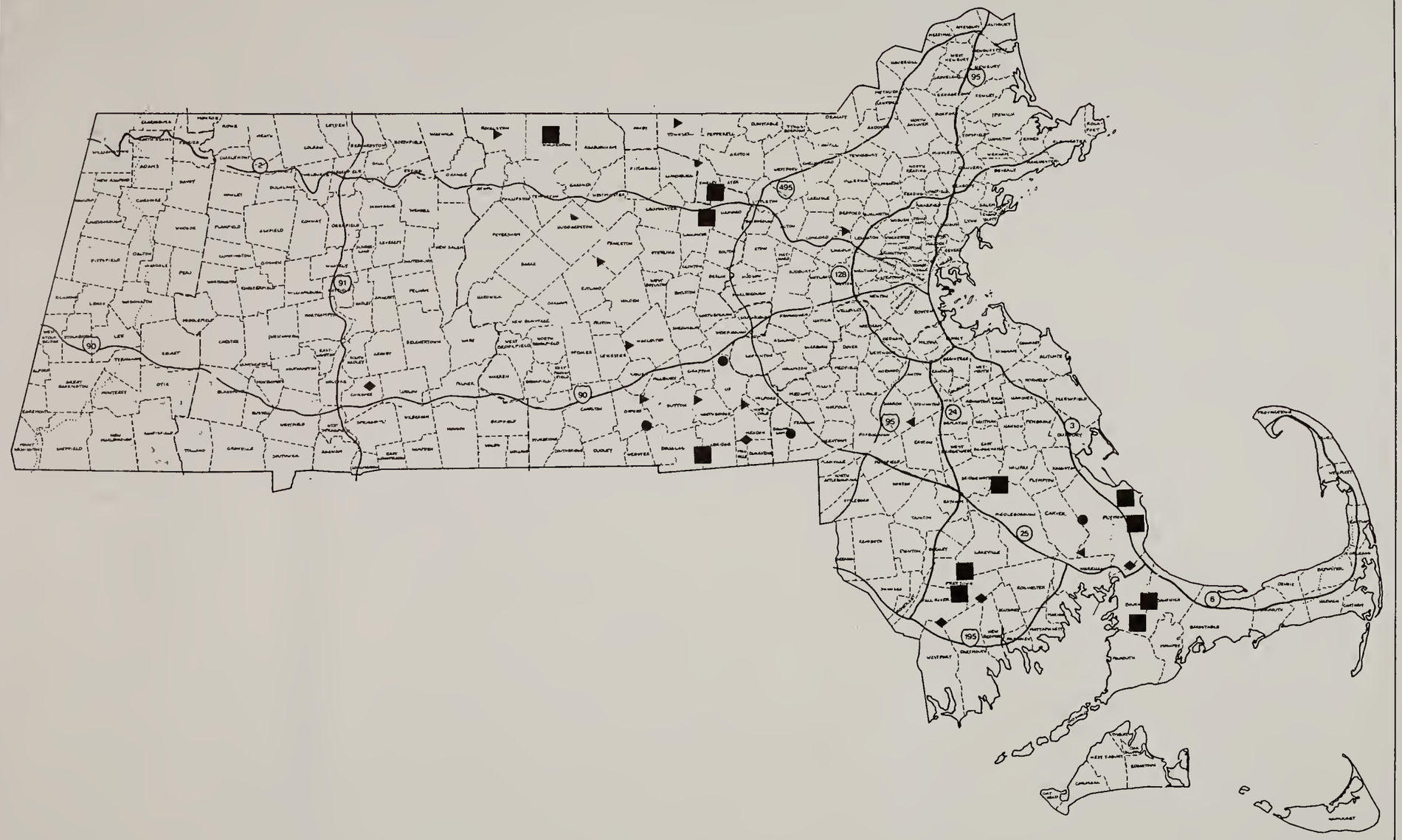
Figure 2

Inventory of Sites



■ Category 1 - Universe of Sites
● Category 1A - Park Sites
◆ Category 2 - Low Ranking Sites
▲ Category 3 - One 10,000 Runway

Note: All locations are approximate

0 20 miles

SECOND MAJOR AIRPORT SITING STUDY

impacts; environmental impacts; land use compatibility; market capture; site features; and transportation features.

The findings of the Part A Study were presented by the Consultant Team to the MAC on November 27, 1990. The Commission voted to take the following action during Part B of the Siting Study.

1. To eliminate from further investigation those sites which cannot accommodate adequate airfield capacity to serve as a SMA. 12 locations - Category 3 (Table 1).

2. To evaluate further those 11 locations which had reasonable characteristics relative to all of the site criteria - Category 1 (Table 1). From these 11 locations it is anticipated that a short list of possible sites will emerge.

3. To hold in reserve those sites which are primarily parkland (Category 1A) or which do not meet a number of the site criteria - Category 2 (Table 1). It was recommended that these sites not be given further consideration during this study, but that they be re-evaluated at a later date if none of the Category 1 sites are deemed to be suitable for further investigation as a site for a Second Major Airport following the conclusion of this study.

	see map	Town	Name/Location
DRAFT POSSIBLE UNIVERSE			
1	A	Harvard/Lancaster/Shirley	Fort Devens (south of Rte. 2)
	B	Shirley/Harvard/Lancaster/Ayer	Fort Devens (north of Rte 2)
	D	Bourne/Sandwich	Otis/Camp Edwards
	D1	Bourne/Sandwich	Camp Edwards/Otis
	P	Plymouth	Digital Site
	M	Middleboro/Bridgewater/Halifax	Location
	G	Douglas/Uxbridge	Location
	BB	Winchendon	Location
	H	Fall River/Freetown	Acushnet Sawmill
	H1	Freetown/Lakeville	Location
	Q	Plymouth	Location, small pri. parcels
SITE IS PRIMARILY PARKLAND			
1A	R	Plymouth/Carver	Myles Standish State Forest
	F	Douglas/ Webster/Oxford	Douglas State Forest, large pri. parcels
	AA	Upton/Grafton/Hopkinton	Upton State Forest
	J	Franklin/Bellingham	Franklin State Forest
LOW RANKING INVENTORY SITES			
2	I	Fall River/Westport/Dartmouth	Location
	L	Mendon/Uxbridge/Millville/Blackstone	Location
	S	Plymouth/Bourne	Location
	K	Dartmouth/New Bedford/Freetown (Park)	Acushnet Cedar Swamp State Reservation
	E	Chicopee	Westover Air Force Base
ONE 10,000' RUNWAY			
3	W	Townsend/Mason NH	Townsend State Forest
	DD	Hubbardston	Location
	T	Princeton/Rutland	Location
	Y	Townsend/Shirley/Lunenburg	Location
	CC	Royalston	Location
	C	Bedford/Concord/Lexington	Hanscom Field
	N	Hopedale/Upton/Mendon	Location
	R1	Plymouth/Wareham/Carver	Location
	V	Sutton/Northbridge	adj. to Sutton State Forest/Purgatory Chasm
	U	Sharon/Stoughton/Easton	Location
	O	Sutton/Oxford/Millbury/Auburn	around Oxford Airport (private, 23 acres)
	Z	Worcester/Leicester	Worcester Municipal Airport

Table 1

Ranked Inventory of Sites

1. PURPOSE OF THE STUDY AND UNDERLYING ASSUMPTIONS

INTRODUCTION: THE NEED FOR A SECOND MAJOR AIRPORT

Over the last decade a number of different studies have examined the likely demand for air travel in New England. While these studies have come to different conclusions about how fast the growth of air travel will occur (forecasts for annual increases have ranged from 1.8% to 4%), they all point to the fact that by about the year 2010, the existing New England airport system will not be adequate to handle all of the passengers who wish to travel. Figure 1.1 describes some of the different studies and their conclusions.

In addition to considering the existing air capacity of Logan Airport and proximate regional airports, the potential for expansion of these facilities and of other travel modes, such as high speed rail connections between Boston and New York, have also been reviewed by Massport and the New England Council.

According to the New England Council's recent report, *Keeping New England's Economy Growing - Observations on the Emerging Crisis in Regional Air Service,* under the most optimistic circumstances, with all possible expansions of air service and initiation of other travel mode improvements, there remains a substantial service gap at Logan Airport in the year 2010 of up to 8 million passengers (see Figure 1.2). The capacity expansions will at best delay the need for a new airport by a few years.

In addition to these local projections of a gap between demand and services, the Boston area falls into that group of cities which is just on the threshold of requiring two major airports based on a review of international air travel markets. These figures are based on originating passengers rather than total passengers (which includes originating, returning and transferring passengers). Within this context, Boston is second only to Atlanta among cities which would be anticipated to need a Second Major Airport (see Table 1.1).

The importance of adequate air capacity to the economic vitality of the region is described in some detail in Chapter 5 of this report. In summary, over the long term, as businesses decide where to locate, as convention planners choose sites for meetings and as individuals make travel plans, the ease, convenience and cost of air travel become important locational factors.

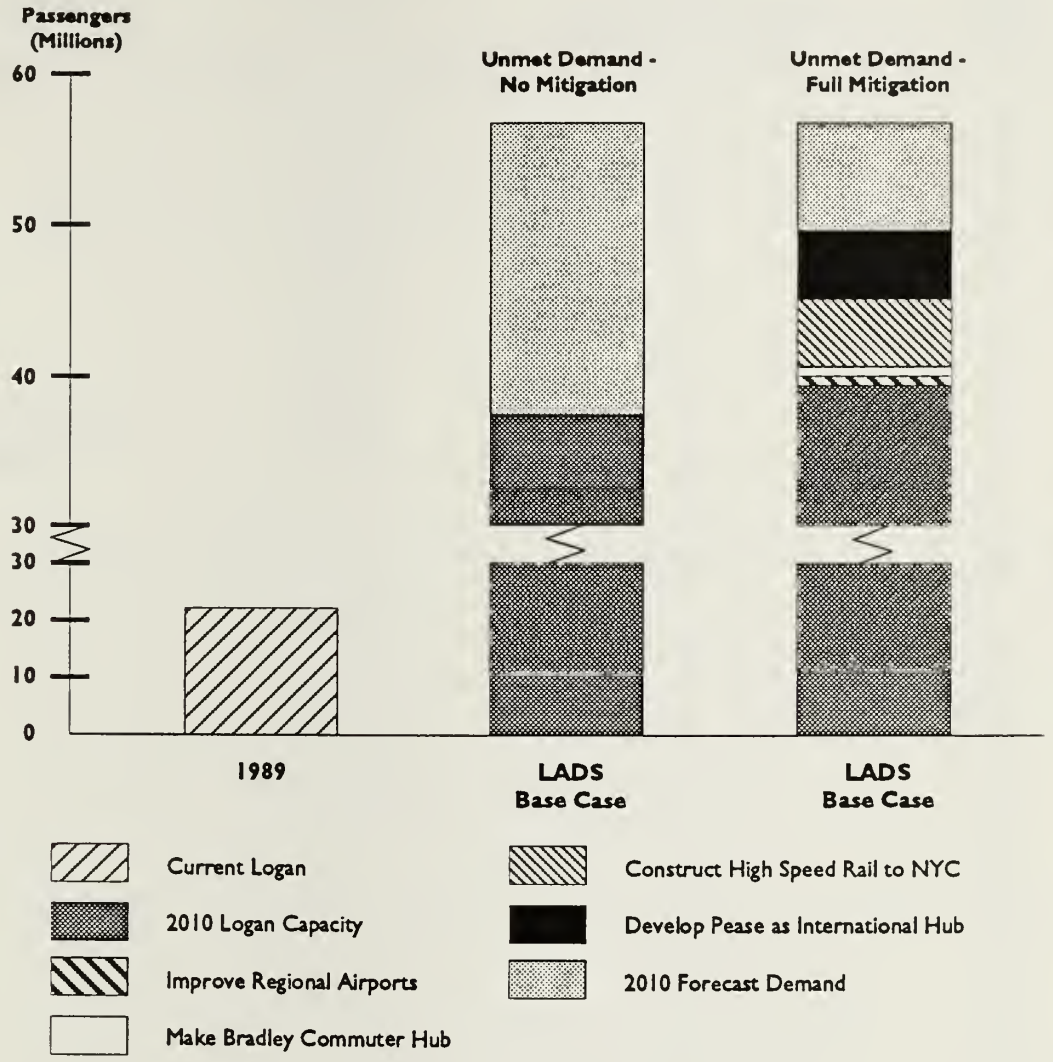
The 1989 Massachusetts Airport System Plan prepared by the Massachusetts Aeronautics Commission concluded that in light of the travel forecasts and the long term economic health of the region, it was appropriate for the state to initiate a study of possible sites for a Second Major Airport in Massachusetts.

	MPA	LOGIC High	LOGIC Low	LADS Base Case	LADS Low Case	FAA
Title	Revised CHART Forecasts	Logan Growth & Impact Control Study	Logan Growth & Impact Control Study	Logan Airport Demand Study	Logan Airport Demand Study	FAA Av. Forecasts FY 1989-2000
Agency Sponsor	MPA	MPA	MPA	MPA	MPA	FAA
Author	MPA Staff	Flight Trnsp. Assoc. (FTA)	Flight Trnsp. Assoc. (FTA)	Simat, Helliesen & Eichner (SH&E)	Simat, Helliesen & Eichner (SH&E)	FAA Staff
Production Date	February 1987	January 1990	January 1990	September 1989	September 1989	March 1989
Activity Forecast	Logan Airport Activity Capacity Constrained	Logan Airport Activity Capacity Constrained	Logan Airport Activity Capacity Constrained	Logan Airport Pass. Demand & Aircraft Ops. Unconstrained by Logan Capacity	Logan Airport Pass. Demand & Aircraft Ops. Unconstrained by Logan Capacity	US Carrier, Top 50 Airports Relatively Unconstrained by Airpt. Capacity
Years Forecast	90, 95, 20, 05, 10	2010	2010	88, 95, 20, 05, 10	88, 95, 20, 10	87, 93, 2000
Base Year	1987	1987	1987	1988	1988	1987
Technical Data Available	yes	no	no	no	no	yes
Major Outputs	Passengers: Annual: Peak hour Peak month Operations	Passengers: Annual: Peak hour Peak month Operations Aircraft Load Factors, Aircraft Fleet Mix, Cargo & Mail	Passengers: Annual: Peak hour Peak month Operations Aircraft Load Factors, Aircraft Fleet Mix, Cargo & Mail	Passenger Demand Annual: Domestic Jet, Commuter, International	Passenger Demand Annual: Assumes Low Personnel Income, High Airline Yields	
2010 Passenger Forecast	37,463,000	43,630,000	35,830,000	56,525,000	43,091,000	43,148,000
Av. Annual	1.8%	4.0%	2.0%	4.0%	2.8%	2.9%
SELECTED MOST LIKELY FORECAST	Capacity Constrained is MPA Staff Forecast 37,463,000 passengers in Year 2010. Unconstrained Demand is LADS Forecast 56,525,000 passengers in Year 2010.					

Source: Keeping New England's Economy Growing - Observations on the Emerging Crisis in Regional Air Service, the New England Council, Inc., October 1990; data derived from a variety of original sources.

Figure 1.1

Forecast of Passengers and Aircraft Operations for Logan Airport



Source: Keeping New England's Economy Growing - Observations on the Emerging Crisis in Regional Air Service, *The New England Council, Inc., October 1990, based on information from Massport, Pease Redevelopment Plan and others.*

Figure 1.2

2010 Logan Passenger Demand and the Impact of Mitigation Measures

Table 1.1. Metropolitan Regions Ranked by Number of Originating Passengers

Metropolitan Region	Multi-airport system	Estimated originating traffic	Total traffic
		(millions of passengers in 1988)	
New York	Yes	31	78
London	Yes	25	62
Los Angeles	Yes	23	57
Tokyo	Yes	22	47
Paris	Yes	16	40
San Francisco	Yes	16	40
Chicago	Yes	15	65
Miami	Yes	12	33
Washington-Baltimore	Yes	12	35
Dallas-Fort Worth	Yes	12	49
Atlanta		11	46
Boston		10	24
Frankfurt		9	24
Houston	Yes, but	8	23
Denver		8	32
Honolulu		7	20
Toronto		6	19
Orlando		6	16
Phoenix		6	16
Seattle		6	15
Hong Kong		6	15
Stockholm		6	13
Philadelphia		5	16
Amsterdam		5	15
Madrid		5	13
Sydney		5	12
Milan	Yes, but	4	10
Montreal	Yes	4	8
San Paolo	Yes, but	3	8
Rio de Janairo	Yes, but	3	8
Oslo	Yes, but	3	7

Note: "Yes, but" means that primary airport is unable to handle international aircraft, so that second airport is an operational necessity.

Source: Flight Transportation Associates

As identified in the state plan, the Second Major Airport (SMA) would be a significant commercial airport to provide additional capacity for passenger and cargo service in the New England region. It would initially serve 5 to 7 million total passengers annually and process about 100,000 tons of air cargo. By the year 2020, it is projected to handle up to 30 million passengers and 200,000 tons of air cargo annually. The MASP stated that to meet the aviation needs of the next century, Massachusetts should begin to identify feasible sites now and reserve the required land area, thus preserving the State's option to construct such a facility in the future. This initial siting study and future actions leading to the acquisition of a site are needed to insure that Massachusetts can meet the air transportation and economic needs of the future.

THE STUDY

The goals of the study are to:

1. Identify possible suitable sites for a Second Major Airport.

2. Develop an Action Plan which describes the steps necessary to choose a Second Major Airport site, and the tools which must be in place to allow communities to plan for the Second Major Airport.

The purpose for carrying out the siting study at this point in time are the following.

- To insure that the State can choose an appropriate site in an orderly manner which is not driven by an immediate crisis in air transportation.

- To insure that a site is available when it is needed, based on the assumption that the acquisition, financing, environmental and development processes will be lengthy.

- To insure that the host community or communities have the tools and time to put in place the mechanisms to provide for growth and change in a manner which is appropriate for local needs.

While important, there are a number of issues which are not relevant or necessary to answer at this initial stage of the siting process. The question of the need for a Second Major Airport will not be re-evaluated, and no new forecasts of air travel demand will be prepared. The definition of the type of airport which would be developed (i.e. international, short-haul, long-haul domestic) will not be addressed by this study. That determination must be made at a point in time much closer to actual development. Finally, the question of whether or not a Second Major Airport will be built in Massachusetts will not be addressed in this work.

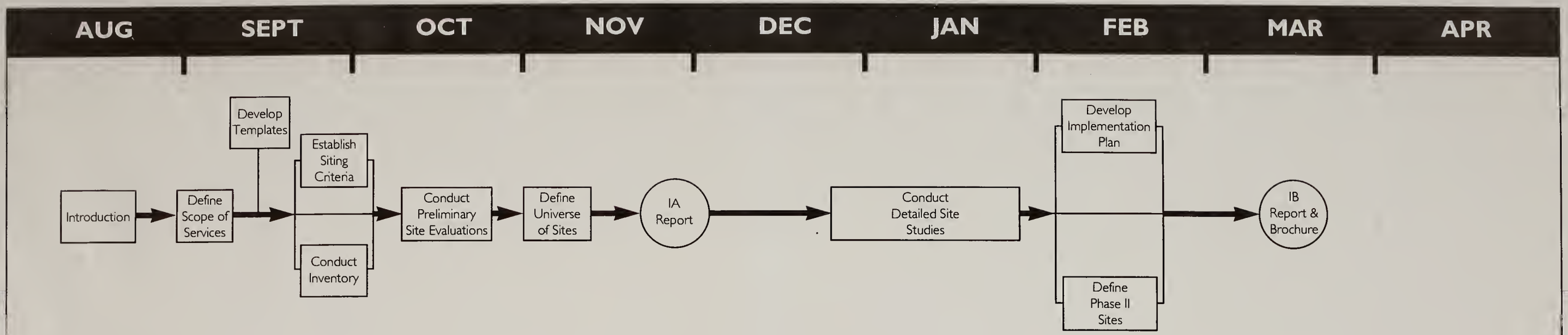
2. STUDY SCHEDULE

The flow chart shown in Figure 2.1 illustrates the project schedule. After an introductory meeting in August, the work got underway in September 1990. Part A, reported on in this document, was completed in December 1990. Part B will be completed by April 1991.

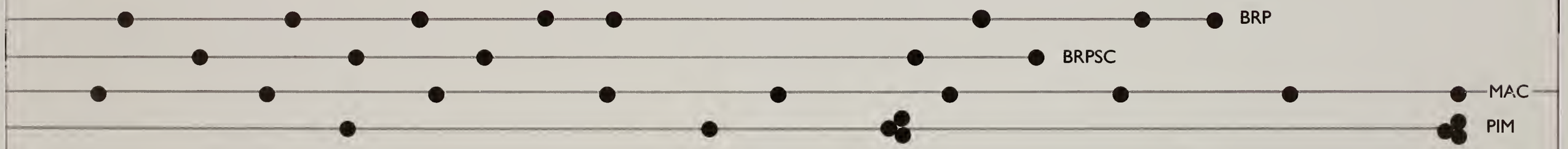
Figure 2.1

Second Major Airport Siting Study

WORK PROGRAM AND MEETING SCHEDULE



Schedule of Meetings:



BRP	Blue Ribbon Panel
BRPSC	Blue Ribbon Panel Steering Committee
MAC	Massachusetts Aeronautics Commission
PIM	Public Information Meeting

SECOND MAJOR AIRPORT SITING STUDY

MASSACHUSETTS AERONAUTICS COMMISSION

3. REGIONAL TRANSPORTATION AND PLANNING

INTRODUCTION

The site selection study for a Second Major Airport in Massachusetts is taking into consideration a broad array of transportation planning initiatives which will have an effect on future planning for the second airport. These initiatives include:

- Northeast Corridor high speed rail
- Commuter Rail improvements
- Major planned roadway projects
- Future plans for Logan Airport
- Regional airport plans and regional air capacity studies
- Vertical Take-Off and Landing Aircraft planning

With the possible exception of increasing service at Bradley International Airport, these planning efforts do not appear to suggest any lessening in the possible future need for a Second Major Airport in Massachusetts. The conclusions reached by the MASP study on the potential need for the airport are confirmed by current plans in the region; planned improvements may delay the need for a Second Major Airport, but they will not eliminate that need.

Planned highway and commuter rail projects have the potential to improve access to a number of the projected sites. However, these improvements are largely envisioned as keeping up with current and projected demand without consideration of a Second Major Airport. Other investments will most likely be needed in the ground transportation network to accommodate a Second Major Airport. The scope of these actions will depend on the final sites selected and upon more detailed studies of the projected character of the airport.

NORTHEAST CORRIDOR HIGH SPEED RAIL

Plans for converting the existing Boston to New York rail connection to high speed service have been underway since at least the 1960's. During the 1970's and early 80's the Federal Railroad Administration undertook a major improvement program for the entire corridor from Washington to Boston. These actions allowed the introduction of the high speed Metroliner service between New York and Washington. Substantial improvements were also made to trackwork and stations along the entire line. Not included in the program were electrification of the Shore Line service from New Haven to Boston together with signal, rail realignments, and operational improvements which were then considered necessary to achieve high speed service on the northern link of the corridor. These improvements were projected to cost in the vicinity of $600 million in

fixed plant costs alone in the Federal Rail Administration's 1985 Northeast Corridor Improvement Program Year Nine Report.

In 1986 the Coalition of Northeastern Governors (CONEG) undertook active planning for completing high speed rail service along the Northeast Corridor with the goal of achieving three hour service from Boston to New York. The proposed three hour service is thought to be competitive with door to door travel by air shuttle. The present minimum travel time on the Shore Line as shown in the current Amtrak schedule is 3 hours and 55 minutes. CONEG concluded that electrification and track geometry improvements are not absolutely necessary to achieve high speed rail service between Boston and New York in the short term. It was found that service times could be cut substantially by using a combination of dual propulsion and tilt train technology . With additional physical and operational improvements, including several interlockings between New Haven and New York, the three hour figure could be achieved.

The current Northeast Corridor rail plan described in the recently published (Fall 1990) "CONEG High Speed Rail Regional Benefits Study" is a phased approach to implementing high speed rail over an 8 year period with a total cost of $570 million in fixed facilities and $307 million in rolling stock. Service will be introduced initially using dual propulsion and tilt train technology. Improvements will continue over the full 8 year period, resulting finally in a fully electrified line with new signal systems, right-of-way, track reconfiguration and operational improvements. Service is projected to include up to 22 round trips per day.

When complete, the new service is expected to increase ridership on the corridor by up to 125%, diverting a projected 2.25 million passengers from air service. Logan Airport currently handles almost 23 million annual passengers of which between 15 and 25% (the Massport Logan Growth and Impact Control Study estimates 15% while the Boston Regional Airport Systems Study estimates 25%) are traveling between New York and Boston. Some of these passengers are making air connections at New York airports while others have non-downtown destinations, and would therefore not be likely to switch to rail.

COMMUTER RAIL IMPROVEMENTS

According to the MBTA there are presently two commuter rail projects in the planning stage which are relevant to the sites which are discussed in this study. These include:

- The Old Colony Lines
- Extension of the Stoughton Branch

Restoration of service on the two Old Colony Lines would bring rail service to a point near downtown Plymouth and to Lakeville near downtown Middleborough on the Middleborough Line. Extension of the Plymouth service to the south could potentially

link with two sites which are located in the Plymouth area; extension of services on the Middleborough Line could create potential links with sites located on Cape Cod. The Old Colony Lines are currently in the planning and environmental review phase.

Future plans for the Stoughton branch may include extension of service to Fall River with a terminal station near Battleship Cove. If this were to occur a future branch might be considered to a nearby airport site in Fall River and Freetown.

MAJOR PLANNED ROADWAY PROJECTS

According to the Executive Office of Transportation and Construction (EOTC) and Central Transportation Planning Staff (CTPS) the following roadway projects which may affect plans for a second airport in Massachusetts are under consideration:

- Route 3 widening
- Route 128 Add-a-Lane Project
- Route 2 Corridor Study
- Route 44

Route 3 is currently under study for possible addition of one lane in each direction between Hingham and Route 139. Additional capacity along Route 3 could improve access conditions for airport sites in Plymouth, Middleborough and at Otis/Camp Edwards.

The Route 128 Add-a-Lane Project is considering adding a lane in each direction between Routes 9 and 24, creating a full 8 lane facility from Woburn to Braintree. Implementing this project could improve access to all the sites under consideration.

The Route 2 Corridor Study is examining an array of possible phased improvements to Route 2, including the eventual grade separation of most of the existing intersections. This phased approach will focus first on the Bedford Road intersection, followed by the Concord by-pass, the rotary at the Massachusetts Correctional Institution at Concord and other intersections. When implemented, these improvements will enhance ground access to sites located along or near Route 2 including Fort Devens and Winchendon.

At Route 44 several improvements are under consideration, including conversion of the road to a four lane divided road between Middleborough Circle and Route 58, and eventual relocation and upgrade of the roadway between Route 58 and Route 3. These improvements could enhance ground access to sites in Middleborough and Plymouth.

FUTURE PLANS FOR LOGAN AIRPORT

Planning for the future of Logan Airport is focused on modernization of terminal facilities, ground access and infrastructure. Taken together these improvements have

been termed the Logan Airport Modernization Program (LAMP). LAMP is projected to be phased over a 10 - 20 year period. A tentative list of major improvements being considered includes the following:

Phase 1 -- Short Term Improvements:

- Improvements to passenger and federal inspection service facilities processing at Terminal E.
- Terminal A replacement (due to structural problems)
- Parking consolidation
- Fuel facility improvements
- A central bus terminal and a bus maintenance facility
- New crash/fire/rescue facilities

Phase 2 -- Mid-term Improvements:

- Additional improvements to Terminals A and E, possibly including some new gates
- A central airport transportation center
- Infrastructure improvements including roadway improvements, heating plant modernization, utility corridors, maintenance facilities, etc.

Phase 3 -- Long Term Improvements:

- New passenger concourse near Terminal E
- Inter-terminal people mover system
- Central passenger terminal
- Remote employee parking
- Cargo development

These improvements are all geared toward modernization of infrastructure and facilities. Major goals include enabling Logan to handle increasing percentages of wide body aircraft, and to improve processing of passengers while taking measures to enhance the attractiveness of mass transportation. The Airport Transportation Center (ATC) which consists of a central bus terminal and air passenger facilities, together with the proposed people mover system, is intended to facilitate passenger access to high-occupancy ground transportation. The terminal improvements listed above which increase capacity are being considered but are not yet programmed. The need for these improvements will be carefully examined over the coming years and will probably not be put in place until the first decade of the next century. The LAMP project is currently projected to enter the environmental assessment phase over the next two to three years.

REGIONAL AIRPORT PLANS AND REGIONAL AIR CAPACITY STUDIES

Regional Airports

MAC's Massachusetts Airport System Plan which incorporates the Boston Regional Airport Systems Study (BRASS) concluded that only marginal changes are likely to occur to the pattern of aviation activities in the Boston region over the next 15 years. With the exception of increased activity at Bradley in commuter and international traffic, service patterns and airport roles are expected to remain largely as they are today. Facilities at most of the airports reviewed in the study are expected to expand somewhat to handle expected growth in their individual markets. This conclusion is supported by discussions of current plans with the airport operators and/or their consultants. Major regional airports include:

- T. F. Green in Rhode Island
- Bradley International Airport in Connecticut
- Manchester Airport in New Hampshire
- Pease Air Force Base in New Hampshire
- Worcester Municipal Airport in Massachusetts

T. F. Green

Green Airport in Warwick, R.I. experienced dramatic growth in the 1980's. Although airside capacity has been available, major constraints exist in the terminal area. The current terminal was completed in 1961. Improvements in 1980 increased capacity to approximately one million total annual passengers. A 750-car parking garage was added in 1987. Green is expected to serve approximately 2.5 million total annual passengers in 1990. Planned actions include a new parking garage, curb improvements, ticketing and baggage claim facilities, new jet gates, new cargo areas and a charter/commuter terminal. This program is now in the environmental documentation phase and will soon be going into design. Improvements will be carried out in two phases beginning in 1992 and 1995.

The airport is also about to begin an update of its master plan. Green is constrained by surrounding noise-sensitive residential uses and no new runways are planned. The major focus of the master plan will be on land use, terminal facilities, general aviation and cargo. Green expects moderate growth through the 90's and improvements will be geared toward meeting that demand. Limitations in the area available for terminal expansion may place additional constraints on growth at some point in the future.

Bradley International Airport

Major improvements are planned at Bradley International Airport. These improvements are aimed at accommodating changes which are expected to happen in the aviation market at Bradley over the next 10 years. These changes may include the

introduction of new international carriers such as KLM with direct flights to Europe, as well as an anticipated increase in commuter hub activities expected at the airport consistent with the strategy outlined in the BRASS study. The Connecticut Department of Transportation has been coordinating with the Massachusetts Port Authority in the exchange of data on operations, origin/destination and activity levels relative to increased commuter hub activity at Bradley. Currently, Logan Airport is the major regional commuter hub with many small feeder flights connecting to services at Boston. With an existing high level of scheduled domestic service and planned new international routes, Bradley is considered to be in a position to share in this role. Bradley is also expecting to attract major new cargo services to the airport.

The airport is currently in the process of completing a major airfield improvement program including runway reconstruction, new pavement, lighting, taxiways, drainage and electrical support equipment. There has recently been an expansion of on-airport parking. A new jetway is being installed at the international arrivals building. The preliminary design of extensive new cargo development is being completed for the west side of the airport, and a new control tower is also under design.

Other improvements under consideration include a new commuter terminal to handle planned increased commuter traffic at the airport. There are also long range plans for another passenger terminal at the airport in addition to the proposed commuter terminal. A new master plan which will cover these and other improvements is expected to be completed next year. All of these investments are planned to help the airport accommodate large projected increases in passenger and cargo traffic. Bradley is currently serving about five million annual passengers which represents a 100% increase over the last 15 years. Annual passenger levels are expected to double again to 10 million over the next 10 years. In order to accommodate these levels and provide improved airport access, a new transit line is being designed to link the airport directly with downtown Hartford.

Manchester

Manchester Airport serves approximately 600,000 passengers per year. Existing landside facilities are at capacity and the airport is currently undergoing a major terminal improvement program with a $40 million plan underway. The new terminal building is expected to be complete in 1994 and will provide 6 new gates with room for future expansion. Although the master plan allows for the possibility of runway expansion, none is likely in the foreseeable future due to site, cost and other factors. Only modest growth is expected over the long term.

Pease Air Force Base

Considerable regional interest has been focused on Pease Air Force Base since the Department of Defense announced its future decommission as an active Air Force Base.

As a result, planning has been ongoing for approximately two years relative to the potential re-use of the 4,235 acre Pease Air Force Base. The preferred option now appears to be a combination of a commercial airport, a wildlife refuge, office/R&D and an industrial and retail center. Plans also call for hotel development and an international trade center at the airport. Commercial airport facilities will be primarily oriented toward cargo, package express, general aviation and aircraft maintenance. There is also interest in attracting a limited number of international commercial air carriers which in turn may be supported by domestic air carrier service. Commuter airlines are also expected to figure in the mix of air services. Total annual air carrier passengers are forecast to reach about 2 million by 2000 and perhaps almost 4 million by 2010.

Worcester Municipal Airport

Worcester is about to begin construction of a $13 million new terminal building for the airport. Work is also to begin soon on a five year environmental assessment for the airport and on an extension of a parallel taxiway for the existing runway system. A noise study is also underway. Runway 15/33 is to be constructed and improvements to the existing navigational systems, including a new instrument landing system (ILS) for one of the runways, are being completed. The various improvements are largely planned to alleviate existing constraints and provide modernized facilities at the airport. No large changes are foreseen in traffic at the airport. Traffic has in fact gone down recently with the discontinuation of Northwest service to the airport. Worcester currently serves about 400,000 total annual passengers. This figure might potentially double over the next 10 to 20 years. Worcester is constrained by difficult terrain, access and weather conditions as well as by neighboring densely populated residential and commercial areas.

Regional Air Capacity Studies

The Logan Capacity Task Force, which is examining options for future capacity at Logan, is the only major capacity work currently underway, with the exception of the Second Major Airport study and the initiatives discussed above. A report summarizing the conclusions of this effort is expected in February of 1991. No preliminary information is presently available.

VERTICAL TAKE-OFF AND LANDING AIRCRAFT PLANNING

Planning for vertical take-off and landing aircraft in the Northeast Corridor has been going on since the 1960's. Studies have focused on vertical take-off and landing aircraft which would land at "metroports" or "vertiports" within or adjacent to metropolitan and suburban centers. Current planning is centered around a 39-seat version of the V22 tilt-rotor aircraft with an approximate speed of about 300-mph. A study is already underway in New York and another is beginning in Boston. New York's vertiport study has recommended a location on Manhattan's west side. The Boston study will be examining a range of suburban sites and a downtown site as well as a potential Logan

service. The focus of the study will be on market analysis and demand relative to alternative sites (and possible interconnections) providing northeast corridor service. The New York study estimates a potential of almost 714,000 annual passengers by 2010. However, a downtown to downtown service may have a similar market to that of high-speed rail and the two services may compete for the same passengers, although rail may be less expensive and thus more attractive to non-business travellers.

4. AIRPORT FOOTPRINTS

INTRODUCTION

In order to determine the most basic physical requirements of possible SMA sites, three generic "airport footprints" were created. These footprints describe airport layout and land requirements, noise contours based on Federal Aviation Administration (FAA) regulations, and a description of compatibility with surrounding land use. The three footprints describe three airport sizes and three passenger levels: 10 million, 20 million and 30 million annual passengers.

The three footprints provided an efficient set of planning tools which were used to test a large number of sites to create the inventory and establish the universe. The footprints allowed testing for airport size and fit, runway configuration, operational flexibility, noise impacts and preliminary land use impacts related to noise.

As the list of sites is narrowed, more site-specific airport layouts, noise contours and land use evaluations will be generated.

AIRPORT SITE AND RUNWAY LAYOUTS

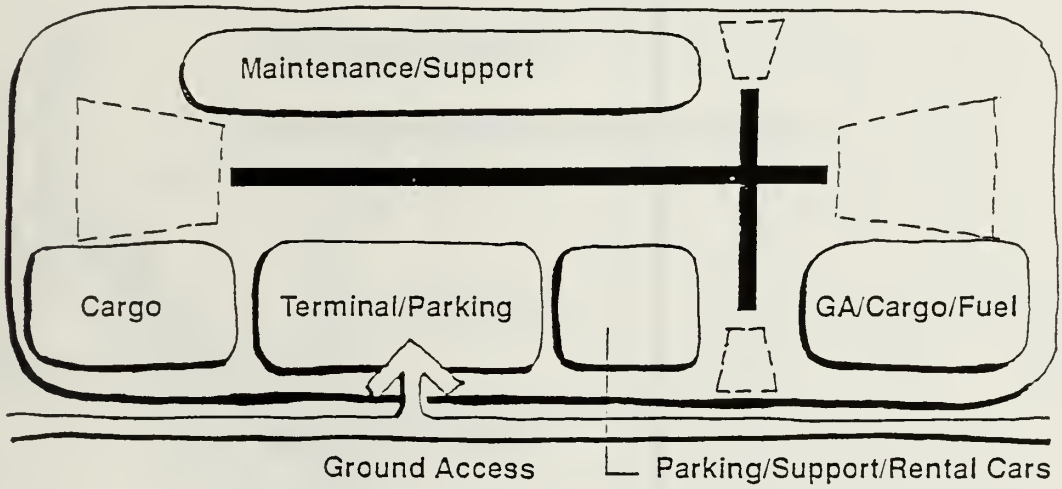
Diagrammatic airport layouts were developed that describe overall land area, number, and length of runways, areas for terminal, cargo, maintenance, fuel, general aviation (GA) (see Figure 4.4 Glossary), and support facilities. The layouts were extrapolated from a survey of 24 major U.S. and European airports.

Early in the study it was decided to develop a range of airport types corresponding to three levels of annual passenger activity: 10 million, 20 million and 30 million annual passengers. Each of these activity levels corresponds to different land area requirements. Although the lower bound of 10 million annual passengers is a smaller capacity than desired, it was decided that the lower acreage requirements (1,500-2,500 acres) would allow for a greater number of potential sites to be included in the search. Given the relative scarcity of open, undeveloped land in Massachusetts, there was some concern that no suitable sites able to accommodate a larger capacity airport would be identified, and thus the smaller sites were included for the first round of identification.

Based on the survey of airports and annual passenger levels, three layouts were developed: a single 10,000-foot runway, a pair of 10,000-foot crosswind runways and independent parallel runways with 5,000 feet of separation. Figures 4.1-3 show the three airport footprints described below.

Footprint 1 - Single 10,000' Runway

Existing major single runway (10,000' jetway) airports handle from 10 to 15 million annual passengers (Sea-Tac in Seattle, Gatwick in London, Athens, San Diego and Milan). The land area required for a single runway airport ranges from 1,500 to 2,500 acres.



* 1,500 - 2,500 Acres
10 Million Passengers

Figure 4.1
Single Runway
AIRPORT LAYOUT FOOTPRINTS

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SECOND MAJOR AIRPORT SITING STUDY

Footprint 2 - Crosswind Configuration of Two Dependent Runways

The cross-wind configuration of two 10,000-foot runways which cannot be operated independently of each other, was based on such existing airports as San Francisco, Newark and Logan. These airports range in annual passenger volume from 15 million to 30 million. The land area of the crosswind configuration ranges from 2,000 to 4,000 acres (Logan 2,375, Newark 2,300, San Francisco approx. 3,300, Frankfurt 4,200).

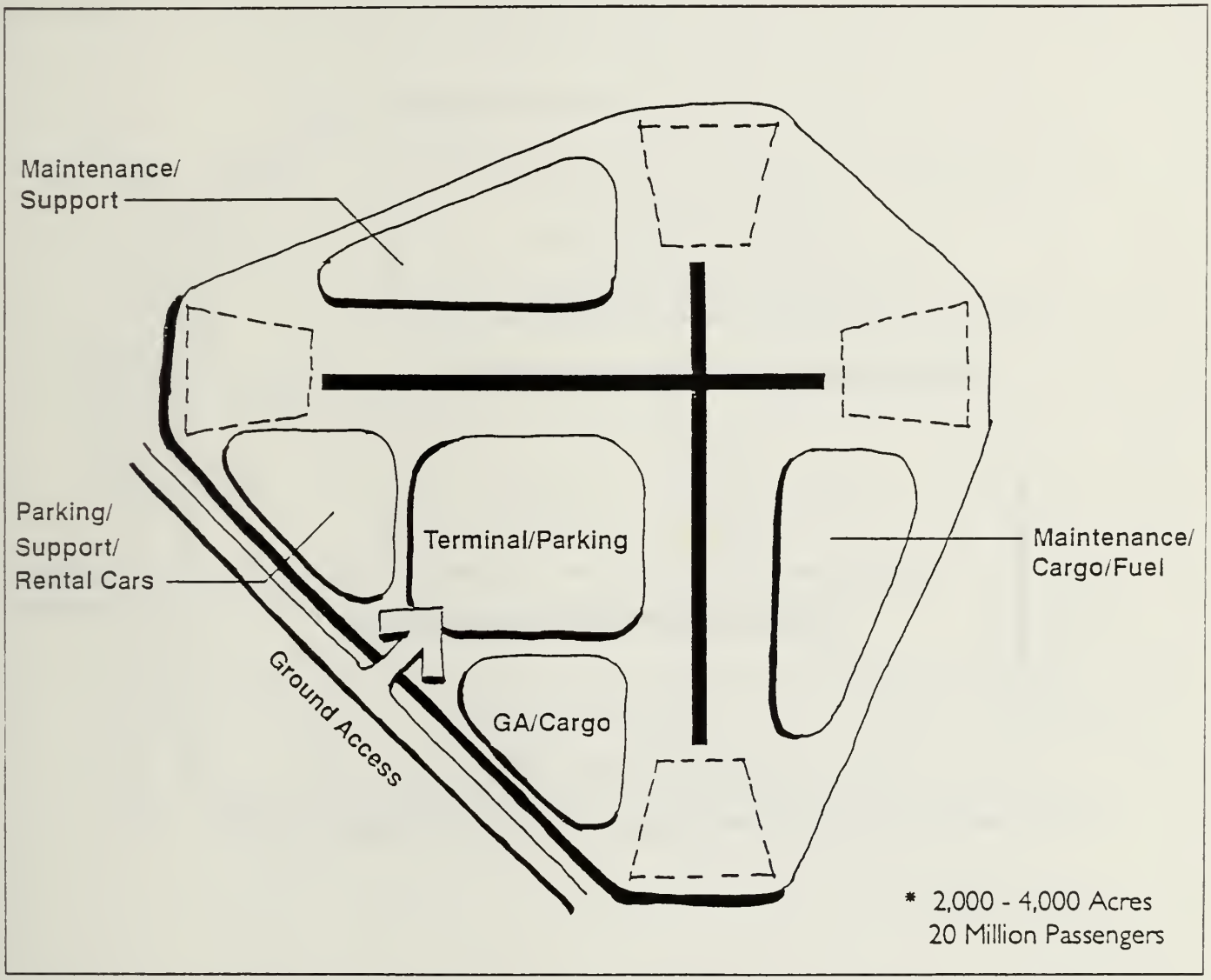

Figure 4.2
Crosswind Runways
AIRPORT LAYOUT FOOTPRINTS

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SECOND MAJOR AIRPORT SITING STUDY

Footprint 3 - Independent Parallel Runways

An independent parallel layout in which the runways are far enough apart that they can be operated independently of each other was based on airports such as Atlanta, Los Angeles, and JFK. The land area required ranges from 4,000 to 5,000 acres (Atlanta 3,750, JFK 4,930). Independent parallel configurations handle passenger volumes, ranging from 30 million to almost 50 million (JFK 30.2 million in 1986, Atlanta 45.2 million in 1986).

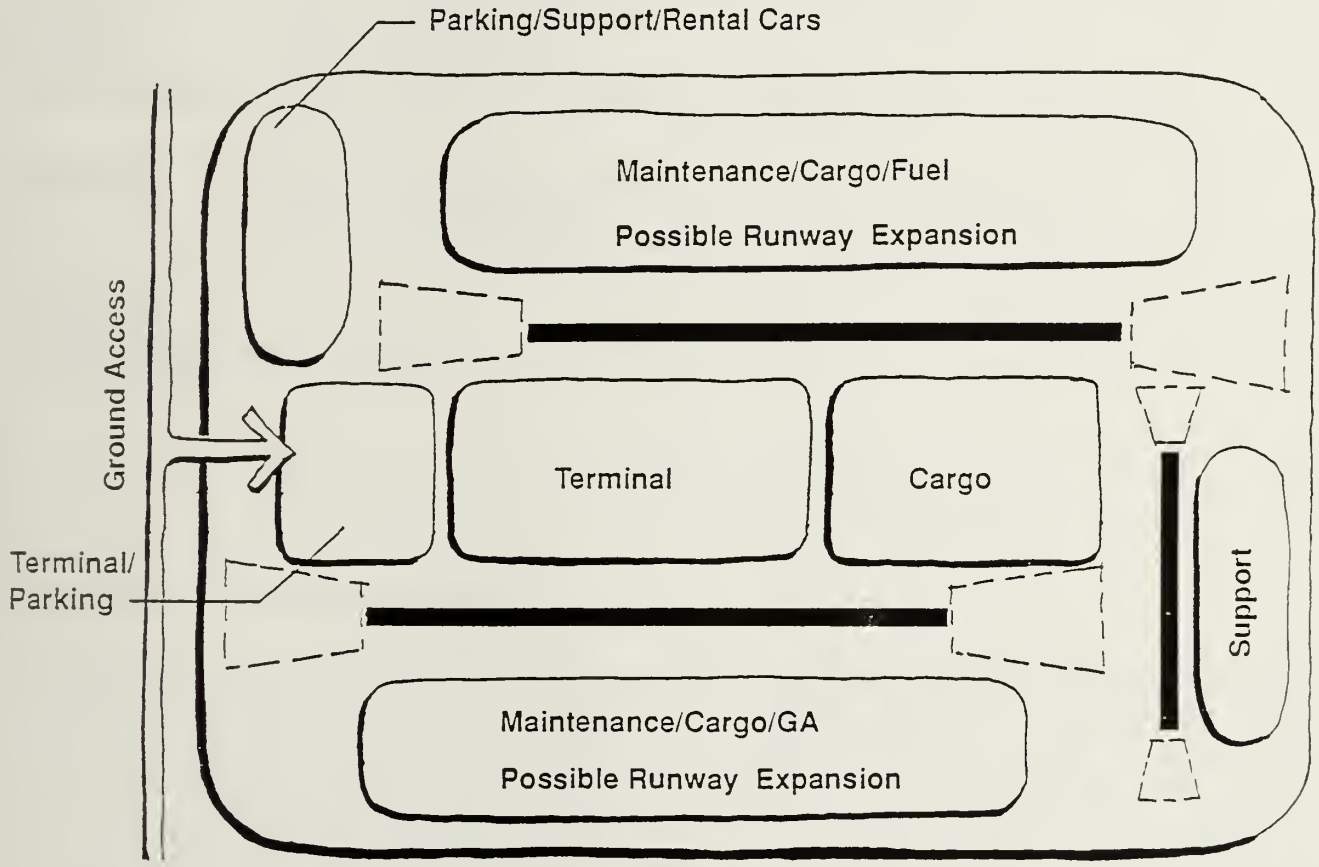

Figure 4.3
Independent Parallel Runways
AIRPORT LAYOUT FOOTPRINTS

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SECOND MAJOR AIRPORT SITING STUDY

10,000 Foot Runway	Standard runway for commercial aircraft operations.
General Aviation	Air traffic other than commercial and military.
Crosswind Runway	Runway which can accommodate operations when wind coverage does not permit operations on the principal runway.
Dependent Runways	Runways on which operations on one runway must be sequenced with operations on the other.
Wind Coverage	Percent of time an aircraft can use a runway for take-offs and landings, based on wind conditions.
Wind Rose	Diagram illustrating the percent of time that the wind is coming from each direction at different speeds.

Figure 4.4
Glossary of Terms

Provision of Crosswind Runways

Footprints 1 and 3 include 4,000- foot crosswind runways. These have been included to accommodate lighter General Aviation aircraft whose tolerance for windy conditions is lower than that of large commercial aircraft. A major turbojet crosswind runway in the independent parallel configuration was also considered. An ultimate configuration with two sets of 10,000 foot independent parallels in a cross-wind configuration could be accommodated within an area of about 5,000 to 6,000 acres. Such a configuration might be similar in some respects to O'Hare Airport in Chicago which contains 6,505 acres and has two pairs of major independent parallels in a crosswind configuration (as well as a three other runways).

Based on this evaluation, it was decided to use a Footprint 3 area of 4,000 to 6,000 acres and to retain the existing layout footprint through the first phase of the study. However, the Footprint 3 sites were evaluated using both parallel and crosswind configurations for land area and noise impacts. The areas labeled "possible runway expansion" on the footprint could accommodate either new closely spaced parallels as at Atlanta or would provide room for two new independent parallel crosswind runways at right angles to the

initial pair. These configurations will be further refined as the short list of sites is established and layouts can address specific site opportunities and constraints.

Runway Orientation

A key question addressed in developing the footprints was that of runway orientation (i.e., the direction of the runway). A preliminary evaluation of the prevailing winds in eastern Massachusetts was made to identify the preferred runway direction, and to determine how much of the time a runway with that orientation could accommodate the needs of commercial aircraft. Crosswind coverage data (see Glossary) for several airports were reviewed, and the historical wind rose (see Glossar) for Hanscom Field (an inland site) was used to estimate the wind coverage for various runway alignments. The present wind rule for Logan Airport was used as the basis for determining runway availability.

Wind information for Hanscom Field indicates that the strongest winds are from the northwest and southwest; the former principally in the winter and the latter in the summer. The wind rose can be used to calculate the percent of the time that a specified crosswind limit would not be exceeded for any desired runway orientation. The conditions under which aircraft can operate are a crosswind of 20 knots for turbojet (large commercial) aircraft, and 15 knots for turboprop and piston (smaller commuter and general aviation) aircraft.

Using the Hanscom data as a guide, the preferred orientation for the primary turbojet runway is northwest/southeast. However, in applying the footprint to potential sites, the orientation has been adjusted as appropriate for local conditions.

NOISE

The evaluation of the potential noise impacts of a SMA requires the prior development of noise exposure contours outlining the area which would experience specific noise levels that would be generated by an airport handling a certain number and type of aircraft operations per year. The noise contour is based on total noise energy which is a result of the total number of aircraft operations of each particular type of aircraft. Two sets of noise contours for each airport footprint were developed.

- One set is based on the kinds of aircraft (noise characteristics, size and number of passengers carried) which use Logan airport in 1990.

- A second set is based on the kinds of aircraft anticipated at Logan in 2010.

The 2010 mix results in significantly smaller contours than those for 1990 because the aircraft themselves are quieter, and because fewer flights are needed to carry the same

number of people because the aircraft are larger, and each flight is anticipated to carry more people than flights in 1990.

Aircraft Operations

In order to estimate the noise impacts of a SMA, the assumed annual passenger volume must be translated into flight operations (landings and takeoffs). This process requires an estimate of the types of aircraft serving the airport and the percentage of the total fleet represented by each type. The average number of passengers carried by each type of aircraft must also be estimated. As noted above, two fleet mixes were used to project the operations.

The annual volume of aircraft operations is calculated by dividing the estimate of annual passengers by the average number of passengers per flight. The results of applying the two fleet mixes to a range of projected passenger operations for the three airport footprints are presented in Table 4.1.

Table 4.1 Estimated SMA Annual Operations

Mix	Annual Passengers	Annual Operations		
		Total	Turbojet	Nonjet
1987 Logan	5,000,000	90,000	51,000	39,000
	10,000,000	180,000	103,000	77,000
	15,000,000	270,000	154,000	116,000
	20,000,000	360,000	205,000	155,000
	30,000,000	540,000	308,000	232,000
2010	5,000,000	58,000	41,000	18,000
	10,000,000	117,000	82,000	35,000
	15,000,000	175,000	123,000	53,000
	20,000,000	234,000	164,000	70,000
	30,000,000	351,000	246,000	105,000

Source: Flight Transportation Associates, Inc.

Noise Contours

The noise analysis used the standard FAA index for determining the cumulative noise exposure of individuals, known as the yearly day-night average sound level or "YDNL" (also expressed as Ldn). The Ldn value is a single number used to describe the time-

varying noise energy occurring over a 24-hour period, with a weighting factor for increased sensitivity to noise during the night (10:00 PM to 7:00AM).

The FAA developed Ldn as a single method for predicting the effects on a population of the average long-term exposure to noise. After many years of study and application, the Ldn has emerged as a workable and efficient tool for use in airport and land use planning and in relating aircraft noise to community reaction. It is used in airport environmental assessments and is the specified descriptor in Title 14 of the Code of Federal Regulations, Part 150 (14 CFR Part 150), which governs the FAA's noise and land use compatibility planning process.

Land use compatibility guidance provided by the FAA relates the noise levels expressed by the contours to various land use types experiencing that noise. The 65 Ldn contour is considered to be the threshold of significant noise impact. The noise at 65 Ldn is equivalent to the sound of an automobile at approximately 100 feet (uses compatible with that noise level are discussed below).

The FAA's Integrated Noise Model (INM) was used to develop the series of noise footprints. For each noise footprint, a set of inputs was formulated involving:

- aircraft operation and fleet mix
- runway utilization
- aircraft flight paths and profiles
- day/night split

Having produced an estimate of the annual number and type of operations that could be expected for the three airport footprints (discussed above), the approximate runway utilization was identified in order to calculate the noise impacts. The potential runway configurations (i.e., single direction operations or combinations of two runways) were determined for each footprint and typical aircraft assignments developed for each one. The annual wind data were used to estimate the percent of the time that each configuration would have to be used to avoid violating the crosswind constraint. When more than one configuration was acceptable, the preferential configuration was assumed to favor northwest and southwest operations.

One straight-in approach track and one straight-out departure track was assigned to each runway in each airport footprint. The arrival and departure profiles used for each aircraft type were those provided in the noise model.

The day/night percentage of aircraft operations was assumed to be approximately 90 percent daytime/10 percent nighttime for all noise scenarios.

Having established the general organizational concepts, site areas and range of annual passengers, fleet mix and operations estimates, a series of noise contours was generated

for each footprint utilizing the INM model. Passenger levels were assigned to each footprint and operations were generated based on the three passenger levels: 10 million for the single runway, 20 million for the cross-wind configuration and 30 million for the independent parallel configuration. The resultant noise contours are shown in Figures 4.5-7. The difference between the forecast noise contours for the 1990 mix and the 2010 mix is quite pronounced. In terms of square miles of area within the Ldn 65 contour, the results are as follows:

Single Runway - Footprint 1

1990 Mix	10 sq. mi.
2010 Mix	2 sq. mi.

Crosswind Configuration - Footprint 2

1990 Mix	18 sq. mi.
2010 Mix	4 sq. mi.

Independent Parallel Runways - Footprint 3

1990 Mix	23 sq. mi.
2010 Mix	6 sq. mi.

The large reduction in the area within the Ldn 65 contour associated with the 2010 mix as compared to the 1990 mix is due to three factors: 1) the increased proportion of Stage 3 (quieter) aircraft in the mix, 2) an increase in the available seating capacity of the future fleet, and 3) larger average passenger load factors. The first factor represents a fleet with quieter aircraft leading to a reduction in average noise levels. The last two factors mean the same number of annual passengers are being delivered with fewer operations, further reducing average noise levels. Because of the great difference in land area exposed to the 65 Ldn contour, and the uncertainty of forecasts in general, it was decided to carry both contours through the initial part of the study. The general consensus among the airline operators and regulatory community is that the 1990 situation will not exist in the future due to attrition and the mandated phasing out of Stage 2 aircraft and that there will be a definite and perceptible reduction in area exposed to noise levels at Ldn 65.

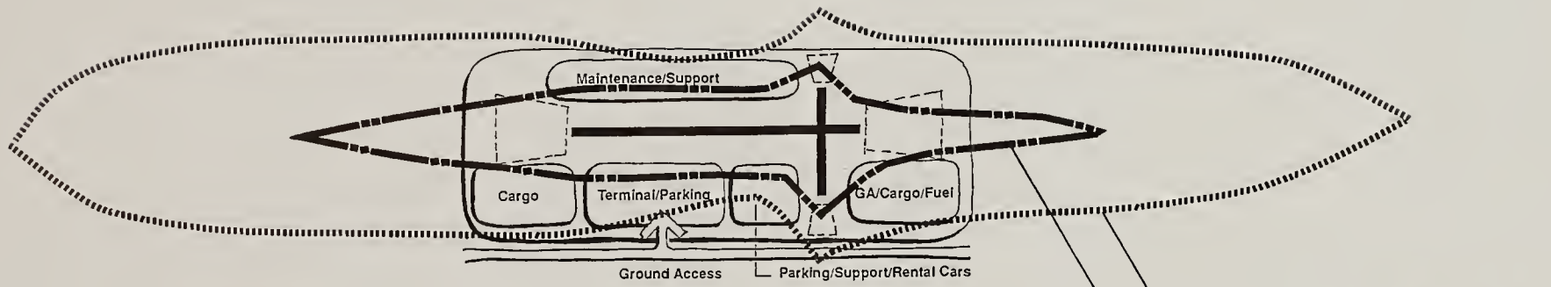
National Trends

In its 1989 Report to Congress on the Status of the U. S. Stage 2 Commercial Aircraft Fleet, the FAA provided a forecast of the nation's fleet mix from 1989 to the year 2010. The forecast estimates that, as the Stage 2 aircraft are phased out and new aircraft are built, the percentage of Stage 3 aircraft in the national mix will increase from about 40 percent in 1989 to 80 percent by the year 2000 and to 100 percent by 2010.

Figure 4.5

Single Runway

AIRPORT FOOTPRINT NOISE CONTOURS



65 LDN - 1990 Logan Fleet Mix
9.6 Sq. Mi.

65 LDN - All Stage 3
2010 Fleet Mix
2 Sq. Mi.

1,500 - 2,500 Acres 2 - 4 Sq. Miles
10 Million Passengers

0 4000

SECOND MAJOR AIRPORT SITING STUDY

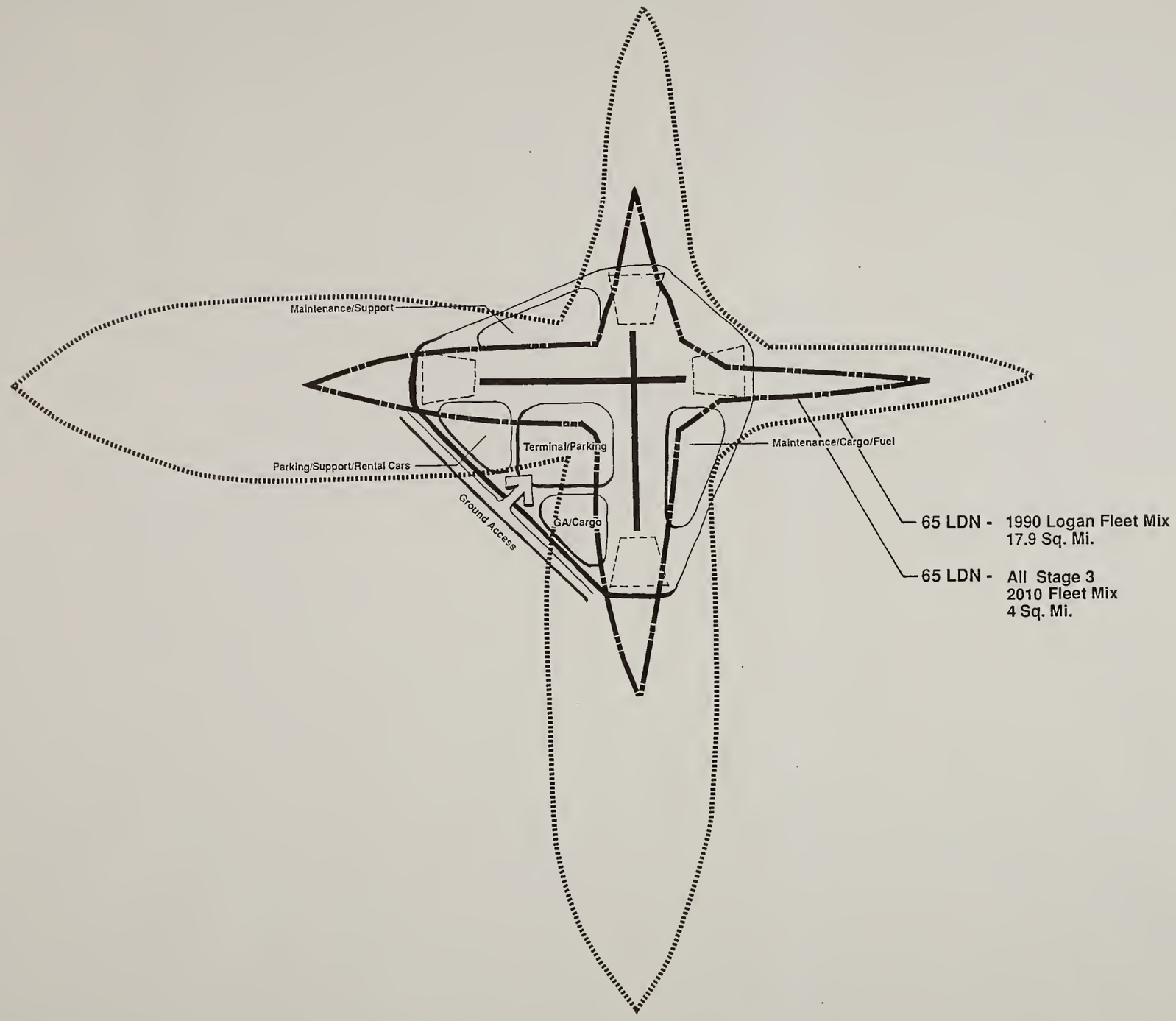


Figure 4.6

Crosswind Runways

AIRPORT FOOTPRINT NOISE CONTOURS

2,000 - 4,000 Acres 3 - 6 Sq. Miles
20 Million Passengers

0 4000

SECOND MAJOR AIRPORT SITING STUDY

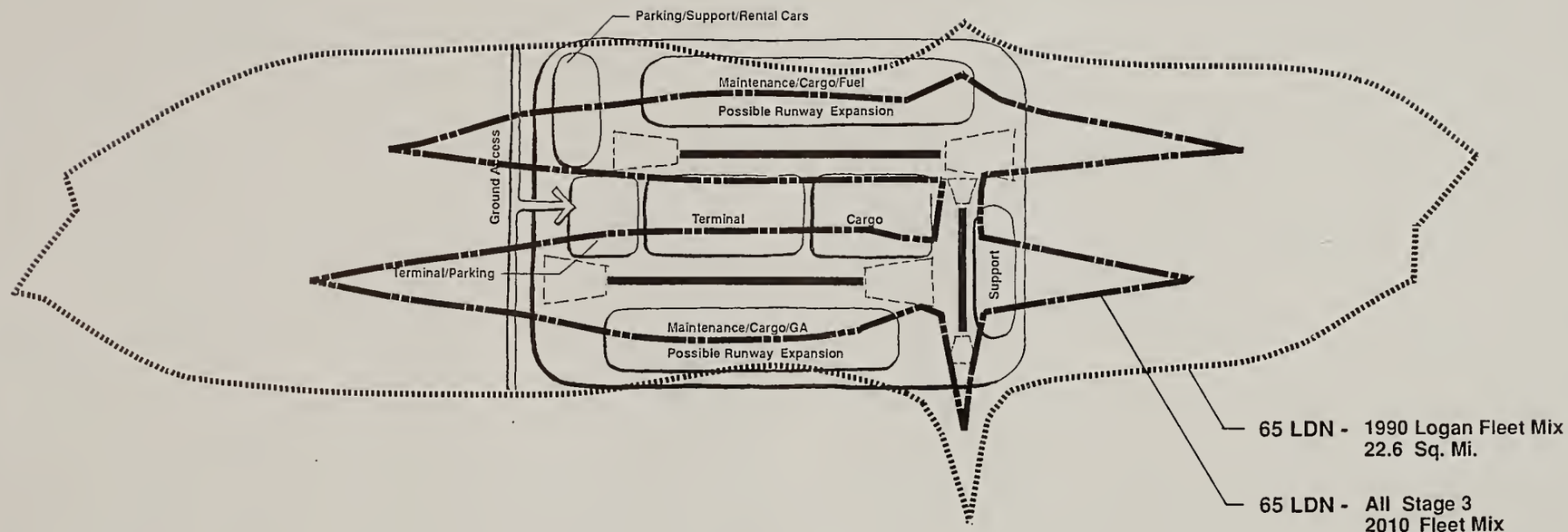


Figure 4.7

Independent Parallel Runways

AIRPORT FOOTPRINT NOISE CONTOURS

4,000 - 6,000 Acres 6 - 9 Sq. Miles
30 Million Passengers

0 4000

SECOND MAJOR AIRPORT SITING STUDY

A key factor in the phase-out is the age of the existing aircraft types. The referenced FAA report also shows the average age of the U.S. aircraft fleet as of 1989. Most of the Stage 2 DC-9s are presently more than 20 years old. By 2010, most of the Stage 2 727-200's will be 35 years old. No new Stage 2 aircraft are being constructed.

More importantly, as a result of recent (November 1990) Federal legislation, no Stage 2 aircraft may be operated at any airport within the continental United States beyond the year 2003. Thus, the projection of a 100% Stage 3 fleet mix is based on both industry trends and federal law.

Logan Airport Trends

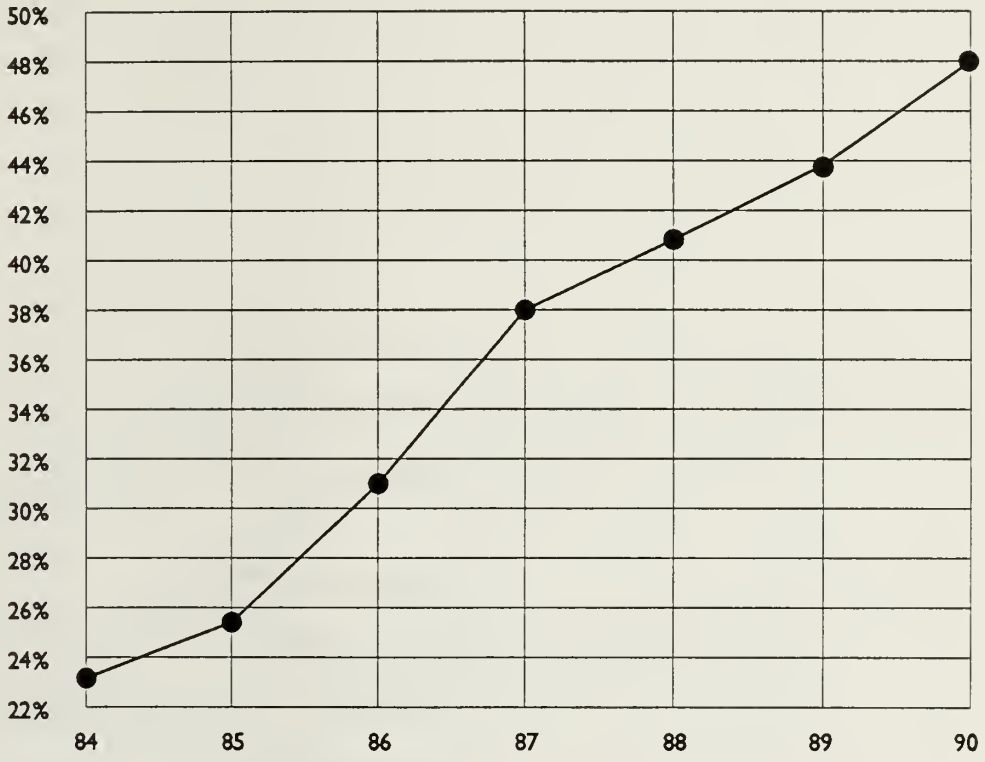
Since 1984, the percentage of Stage 3 aircraft in the Logan mix has steadily increased, as shown in Figure 4.8. The Logan Stage 3 mix has increased from 23 percent in 1984 to an estimated 48 percent in 1990.

Figure 4.9 illustrates the noise contours which would result from four different aircraft and operational scenarios. This clearly shows the dramatic changes effected by quieter jet engines (Stage 3 aircraft), and larger aircraft with more passengers using each flight.

LAND USE

Land use impacts surrounding the airport site are largely determined by compatibility with forecast noise levels. Thus land use compatibility is strongly linked to the forecast noise contours which are the principal planning tool specified by the FAA. Programs for airport noise compatibility planning are governed by the rules set forth in 14 CFR, Part 150 (also referred to as Federal Aviation Regulations or FAR Part 150). Part 150 also sets guidelines to determine land uses which are are compatible with noise exposures over 65 Ldn using the Ldn descriptor. Land use compatibility guidelines from FAR Part 150 are shown in Table 4.2.

In general, residential land uses and some institutional uses such as hospitals, schools, churches and auditoriums or concert halls are listed as incompatible with noise levels over 65 Ldn without inclusion of indoor sound level reduction measures. Compatible uses for noise levels between 65 and 70 Ldn include some institutional uses as well as industrial, transportation, commercial (including office and retail), agricultural/forestry and active recreational facilities. Parks, resorts, camps and nature exhibits are also listed as compatible uses. Although not specifically listed, undeveloped open space and large areas of open water can also be considered as a compatible use and even as possible buffer zones. Above 70 Ldn most uses are listed as incompatible unless indoor noise sound level reduction measures are incorporated into the planning and design of any related structures. Exceptions to this 70 Ldn limit include transportation facilities, manufacturing uses, and certain high intensity sport or amusement facilities.



Source: Massport

Figure 4.8

Stage 3 Aircraft Percentage by Year

LOGAN AIRPORT: SCHEDULED PASSENGER FLIGHTS

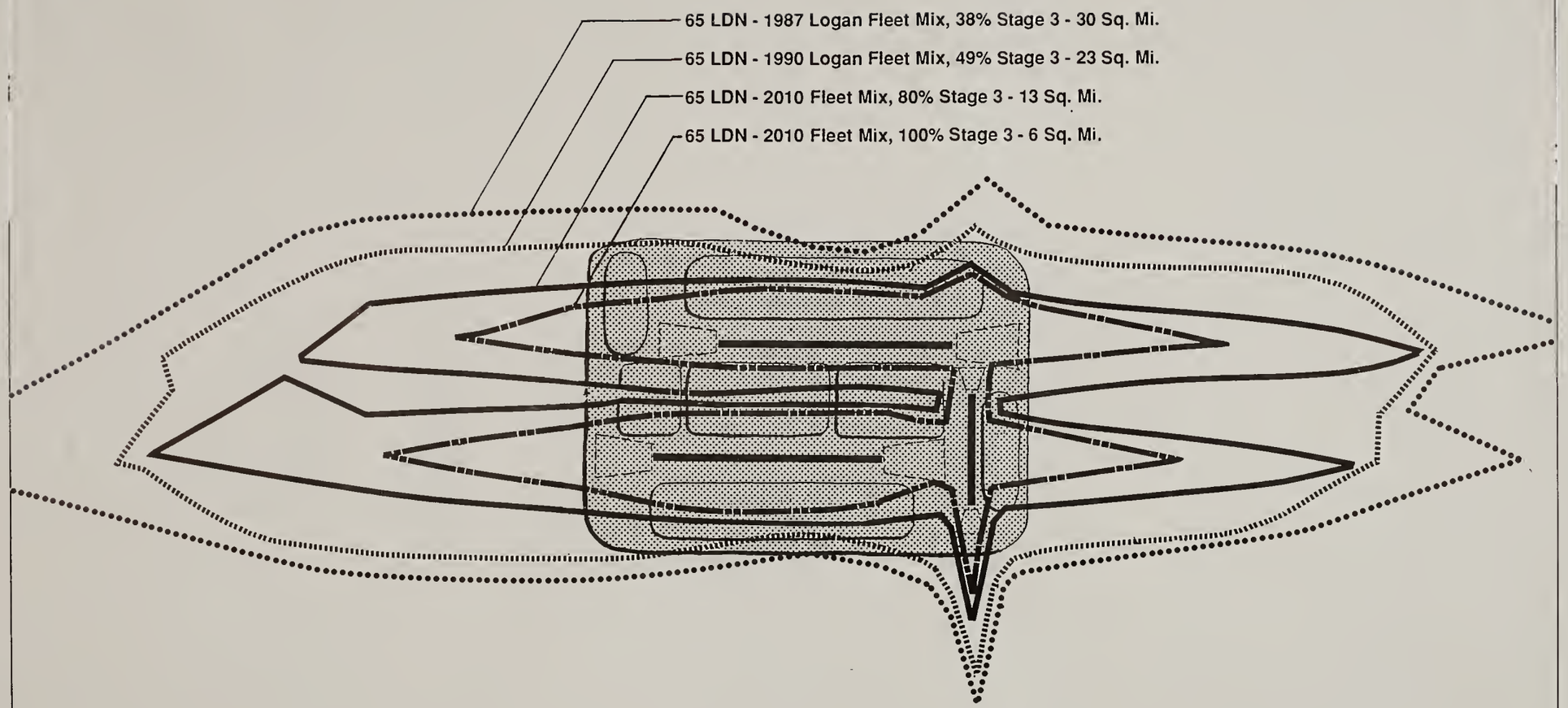

65 LDN - 1987 Logan Fleet Mix, 38% Stage 3 - 30 Sq. Mi.
65 LDN - 1990 Logan Fleet Mix, 49% Stage 3 - 23 Sq. Mi.
65 LDN - 2010 Fleet Mix, 80% Stage 3 - 13 Sq. Mi.
65 LDN - 2010 Fleet Mix, 100% Stage 3 - 6 Sq. Mi.

Figure 4.9

Independent Parallel Runways

NOISE CONTOUR TRENDS

4,000 - 6,000 Acres 6 - 9 Sq. Miles
30 Million Passengers

0 4000

SECOND MAJOR AIRPORT SITING STUDY

Land Use Compatibility* With Yearly Day-Night Average Sound Levels

Land use	Yearly day-night average sound level (L_{dn}) in decibels					
	Below 65	65–70	70–75	75–80	80–85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings.	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals end nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Trensportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professionel	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardwere end farm equipment.	Y	Y	Y(2)	Y(3)	Y(4)	N
Reteil trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photogrephic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction.	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits end zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables end water recreation.	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

*The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropnate by local authonties in response to locally determined needs and values in achieving noise compatible land uses.

Key to Table 1

SLUCM = Standard Land Use Coding Manual.
Y (Yes) = Land Use and related structures compatible without restrictions.
N (No) = Land Use and related structures are not compatible and should be prohibited.
NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35 = Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes for Table 1

(1) Where the community determines that residential or school uses must be allowed, meesures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
(2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(4) Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low.
(5) Land use compatible provided special sound reinforcement systems are installed.
(6) Residential buildings require an NLR of 25.
(7) Residential buildings require an NLR of 30.
(8) Residential buildings not permitted.

Source: Title 14, Code of Federal Regulations, Part 150

Table 4.2
Land Use Compatibility

As the airport footprints are applied to the various sites, the general pattern and density of existing land use and development lying within the 65 Ldn contour can be determined. As the short list of sites is developed, existing land use patterns will be examined in more detail. Alternative methods for dealing with the compatibility of surrounding existing and proposed land uses will be examined. Possibilities for achieving or assuring future noise-compatible uses surrounding the airport include both airport owner/operator options and state and local government actions. The table in Figure 4.10 has been reproduced from the FAA's Advisory Circular: "Noise Control and Compatibility Planning for Airports". The table shows an array of possible solutions to noise compatibility problems.

The most direct airport owner/operator approach may be to change either the airport layout and/or aircraft operations. By shifting the orientations of certain runways it may be possible to minimize or avoid impacts on existing uses. Operational methods can include preferential runway usage and curving the approach and departure tracks away from sensitive areas. Noise can also be reduced through regulatory procedures such as full or partial curfews, restriction of aircraft not meeting Federal noise standards, landing fees based on noise emissions, regulations for carriers which limit cumulative noise impact or the percentage of operations of certain aircraft types according to certificated noise levels (such as Stage 2 aircraft), and other rulemaking procedures.

Other methods which can involve both the airport owner as well as state and local government include land or easement acquisition to provide buffer areas and/or navigation easements, use of local zoning to prohibit incompatible uses or development incentives to encourage compatible development of noise-impacted areas such as transfer of development rights (TDR). Capital improvements projects can also be used as a method of achieving noise compatibility by locating noise-compatible public works projects or uses, such as maintenance and equipment storage, etc., in noise-affected areas. Other possible methods include purchase and resale of land with covenants assuring compatible use of the land. Lastly, purchase assurance and/or sound-proofing programs can be put into effect for residential uses affected by the projected noise contours.

Airports can also have other land use impacts including induced development impacts to the surrounding area. These impacts can be difficult to predict in any simple, generalized way from the experience at other airports, because of the many different settings in which airports are located and the varying attitudes and policies toward change and development in the surrounding communities. Likely impacts include increased demand for hotel, commercial, light industrial and airport-related uses (such as freight forwarders, rental cars etc.) in the surrounding area. But how much and to what extent will depend on the proposed setting, what type of market the airport serves, existing competing uses, and how much space is allocated for such uses on-airport.

CONSIDER THESE ACTIONS		IF YOU HAVE THIS PROBLEM:	NOISE FROM: TAXIING	DEPARTURE	APPROACH	LANDING ROLL	TRAINING FLIGHTS	MAINTENANCE	GROUND EQUIPMENT
AIRPORT PLAN	Changes in Runway Location, Length or Strength	1	●	●	●	●	●		
	Displaced Thresholds	2			●		●		
	High–Speed Exit Taxiways	3	●			●			
	Relocated Terminals	4	●					●	●
	Isolating Maintenance Runups or Use of Test Stand Noise Suppressors and Barriers	5	●					●	●
AIRPORT AND AIRSPACE USE	Preferential or Rotational Runway Use *	6	●	●	●	●	●		
	Preferential Flight Track Use or Modification to Approach and Departure Procedures *	7		●	●		●		
	Restrictions on Ground Movement of Aircraft *	8	●						
	Restrictions on Engine Runups or Use of Ground Equipment	9						●	●
	Limitations on Number or Types of Operations or Types of Aircraft	10	●	●	●	●	●	●	●
	Use Restrictions Rescheduling Move Flights to Another Airport	11	●	●	●	●	●	●	●
	Raise Glide Slope Angle or Intercept *	12			●		●		
AIRCRAFT OPERATION	Power and Flap Management *	13		●	●		●		
	Limited Use of Reverse Thrust *	14				●			
LAND USE	Land or Easement Acquisition	15	●	●	●	●	●	●	●
	Joint Development of Airport Property	16	●	●	●	●	●	●	●
	Compatible Use Zoning	17	●	●	●	●	●	●	●
	Building Code Provisions and Sound Insulation of Buildings	18	●	●	●	●	●	●	●
	Real Property Noise Notices	19		●	●	●	●	●	●
	Purchase Assurance	20		●	●	●	●	●	●
NOISE PROGRAM MANAGEMENT	Noise–Related Landing Fees	21	●	●	●	●	●		
	Noise Monitoring	22		●	●		●	●	
	Establish Citizen Complaint Mechanism Establish Community Participation Program	23	●	●	●	●	●	●	●

Note: These are examples of restrictions that involve FAA's responsibility for safe implementation. They should not be accomplished unilaterly by the airport operator. *Source: FAA AC 150/5020-1*

Figure 4.10

Matrix of Noise Control Actions

An important consideration with regard to induced development is its potential to assist in assuring future noise compatibility around the airport. This can be done through land or easement acquisition and through rezoning to create new areas for induced commercial and light industrial uses in noise-affected areas, perhaps even including noise reduction requirements for new construction.

5. ECONOMIC IMPACTS

SUMMARY

Airports provide tremendous economic benefit to the region in which they are located. These benefits include creation of airport-related jobs, support of regional businesses through provision of vital transportation links to distant markets, and support of local businesses through the purchase of goods and services.

A preliminary estimate of the economic impacts of the SMA has been developed to assist in the site screening process. It consists of three models which indicate a range of possible economic benefits of each of the three respective airport passenger levels: 10, 20 and 30 million. Each model presents a range of direct, indirect and induced impacts, and jobs for the associated level of activity. At this stage of the study, the economic impacts are considered to be relatively independent of airport location, and primarily related to the volume of traffic at the potential airport. To a large extent, the underlying assumptions rely on extrapolations from data obtained for Logan. In the more detailed analyses of the short list of sites, the estimated economic impacts will be refined to reflect specific location and current data.

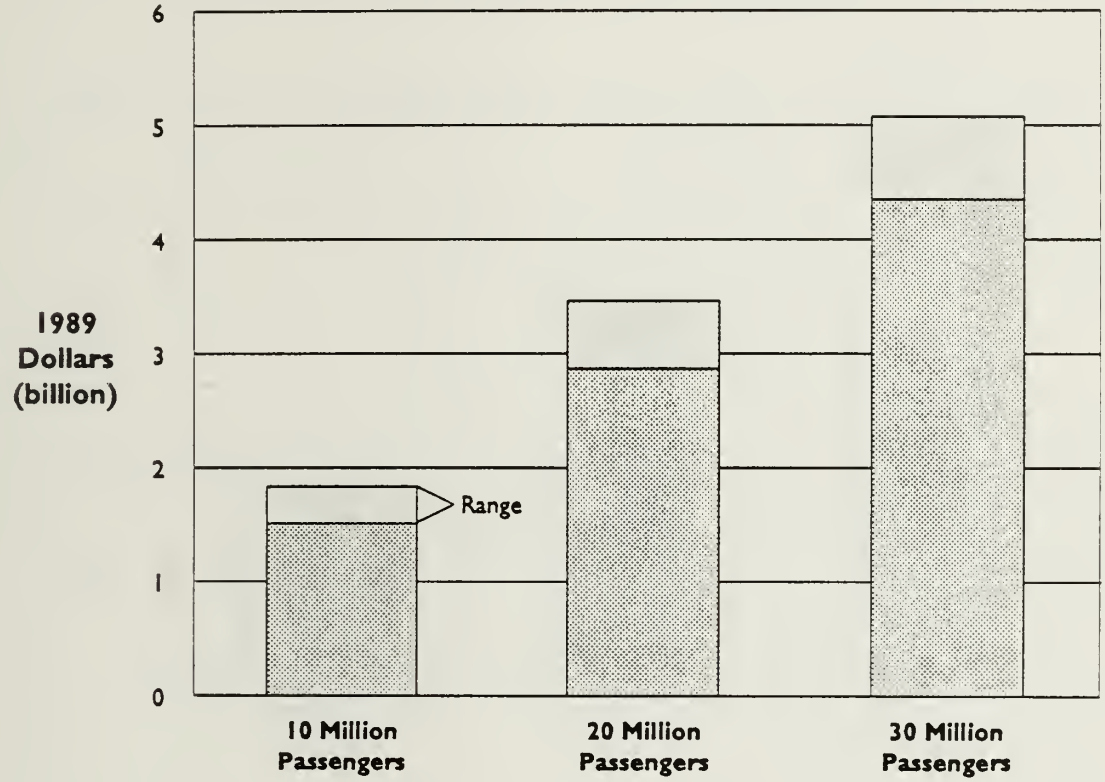
Figure 5.1 presents the total direct, indirect and induced economic impacts of a Second Major Airport with annual passenger levels of 10, 20 and 30 million. The total economic impact ranges from about $1.5 billion to around $5.0 billion per year, depending on the level of operations.

Figure 5.2 illustrates the number of jobs generated by a Second Major Airport at annual passenger levels of 10, 20 and 30 million. The number of permanent jobs produced ranges from about 10,000 to over 50,000. The range of job types and educational background required are discussed below.

DEFINITION OF TERMS

The primary economic impacts of an airport accrue to businesses and employees whose activity is directly related to and identifiable with the aviation industry. They can be classified as on-site (direct) and off-site (indirect) activity.

The direct impacts result from economic activities occurring at the airport by airlines, airport management, fixed-base operators and other tenants with a direct involvement in aviation. They include car rental companies, airport concessions and FAA operations. The economic benefits derive from employing labor, purchasing locally-produced goods

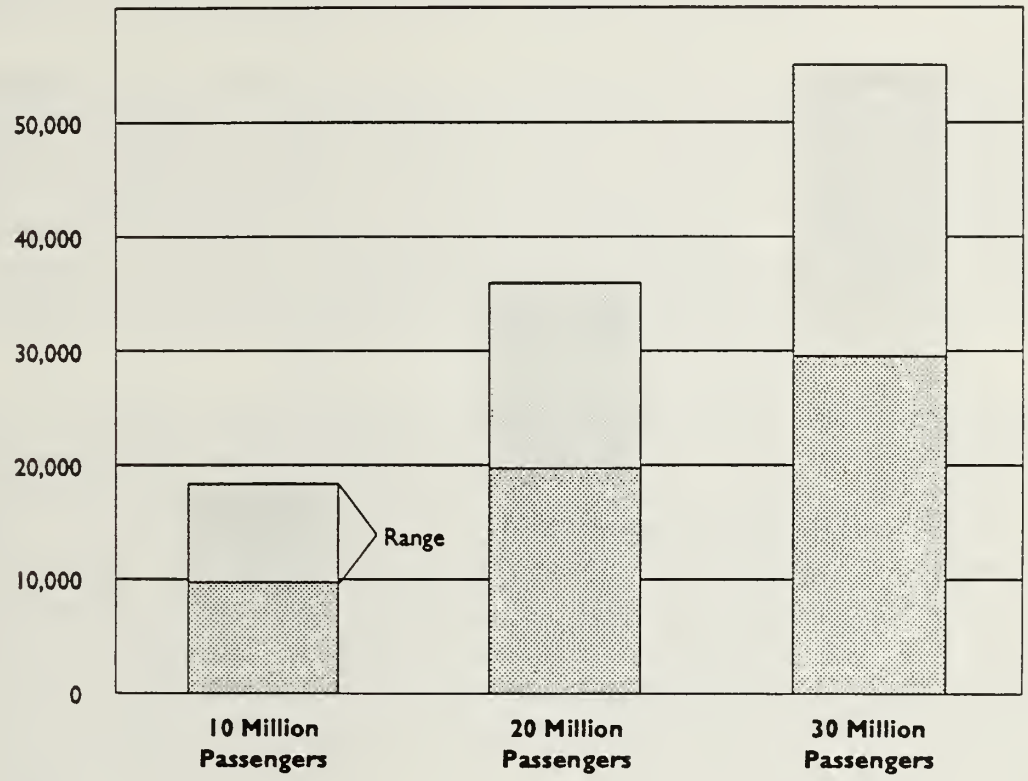


Source: Flight Transportation Associates, Inc.

Figure 5.1

Economic Impacts of a Second Major Airport

(TOTAL DIRECT, INDIRECT AND INDUCED)



Source: Flight Transportation Associates, Inc.

Figure 5.2

Jobs Generated by a Second Major Airport

and services, and contracting for airport capital improvements. The measures of these benefits are employment, payroll, and other expenditures.

Indirect impacts result primarily from off-site economic activities that are attributable to the airport. They include visitor related industries provided by hotels, restaurants and retail establishments, as well as aviation-related companies such as travel agencies and freight forwarders. Such enterprises also employ labor, purchase locally-produced goods and services, and invest in capital expansion and improvements.

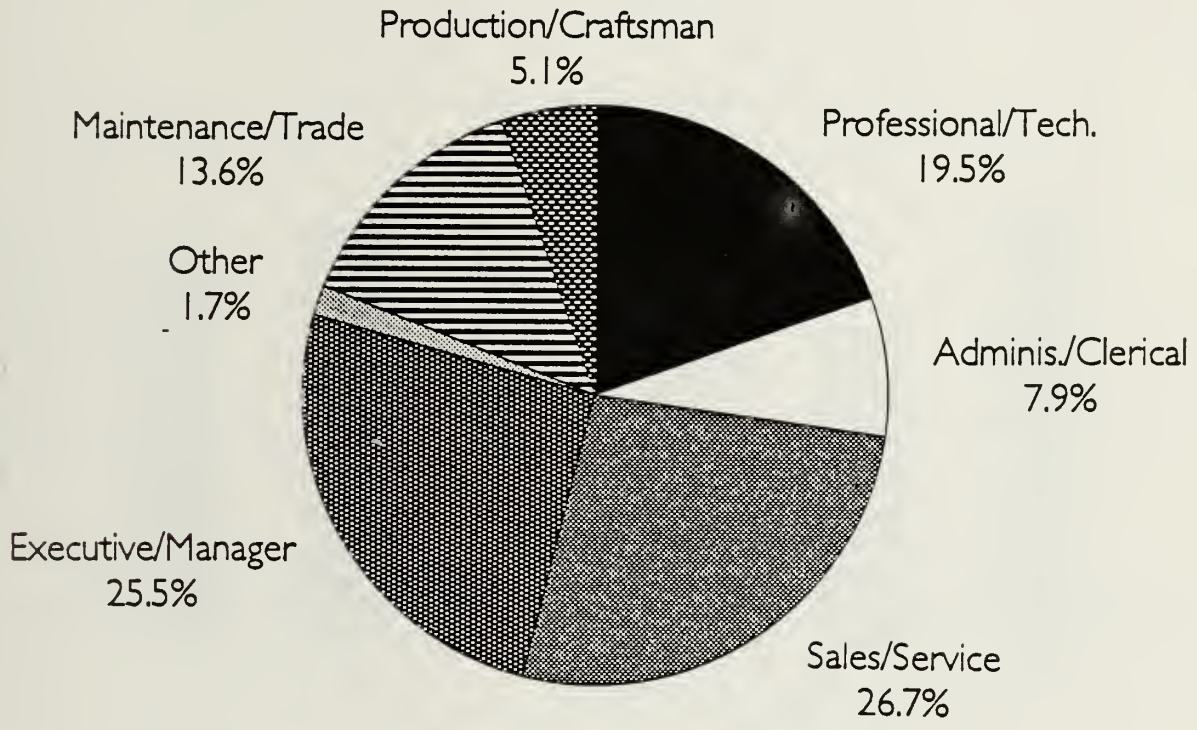
Induced impacts are also referred to as the "multiplier effect" and encompass the cycling of airport generated dollars and spending through the local and state economies. For example, airport employees spend a portion of their income locally on goods and services such as food, clothing and medical services. These purchases support local jobs and provide income to local business owners and their employees. These individuals, in turn, use a portion of their income to purchase goods and services locally. As these successive rounds of spending occur, additional income and jobs are created and/or supported.

In addition to purchases made by airport employees, businesses involved in airport activity, and the airport itself, purchase items necessary for business operations. For example, the airlines purchase mechanical parts, catering services, janitorial services, and office supplies from local firms, thereby supporting jobs and providing income to these supplying industries. The airport purchases services such as contract construction, utilities and maintenance services from local suppliers, also creating jobs and providing income to the local economy. A second round of purchases then occurs by these firms for the operation of their businesses -- the parts suppliers purchase machinery and tools, catering firms purchase food, janitorial firms purchase cleaning supplies and uniforms, and office supply firms purchase their inventory. This second round of purchases generates additional income and jobs in the supplying industries within the region. Successive rounds of business purchases continue, providing additional benefits to the regional economy.

EMPLOYMENT GENERATED BY AIRPORT ACTIVITY

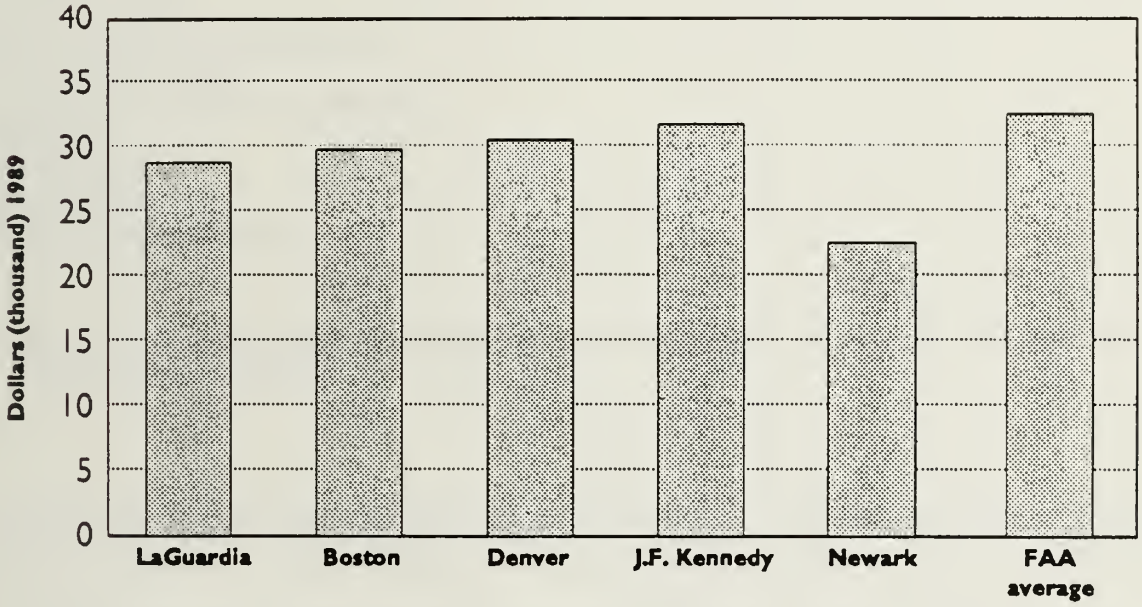
A significant aspect of the economic impact of aviation is the generation of jobs. For example, Logan serves approximately 23 million passengers per year with about 16,000 total on-airport employees. Figure 5.3 illustrates the breakdown of job types at Logan and Figure 5.4 illustrates average on-airport salaries at several major U.S. airports.

In this preliminary economic impact analysis, the exact number and type of jobs generated will not be predicted. However, by presenting a list of job types, the nature of the employment opportunities created by the development of a major airport can be characterized. The job types are displayed in Tables 5.1 and 5.2 below. Table 5.1 indicates



Source: *Massport Logan Employee Survey*

Figure 5.3
Logan Job Types
(1990 ESTIMATE)



Source: Compiled by Greiner, Inc. from Economic Impact Reports published by the individual airports.

Figure 5.4

Average On-Airport Salaries

the major categories of jobs which are generated and Table 5.2 lists the types of businesses which are affected.

Table 5.1. Economic Impact - Job Categories

Direct Jobs:
- Airline/Airport Service
- Freight Transportation
- Passenger Ground Transportation
- Contract Construction/Consulting

Indirect and Induced Jobs:
- Financial and Business Services
- Food and Beverage
- Residential and Other Construction
- Apparel
- Transportation
- Health Care
- Lodging and Amusement

Source: Derived from New Denver Airport Environmental Assessment, prepared by the City and County of Denver, November, 1988

In the text below, each of the industries listed in Table 5.1 is briefly described. Examples of job types are given, as well as typical responsibilities and educational requirements.

Airline/Airport Service. This category includes those employees who are directly responsible for the operation and management of the airport and its airline clients. Examples of airport jobs include managers, security personnel, building service technicians, etc. Airline jobs include pilots, baggage handlers, machinists, attendants, and managers. A wide range of job skills is represented in this category, both manual and managerial. Educational backgrounds range from high school only, to vocational school, to university, including advanced degrees.

Freight Transportation. The segments of the freight transportation industry referred to in this context are those which are related to the aerial shipment of cargo, including small package express freight. Examples of job types in this category include cargo specialists, forklift operators, clerks, etc. The majority of jobs in this industry do not require four-year college degrees, although some require vocational training.

Table 5.2. Direct Impact Categories

Business

Airport Management
- Administration
- Construction
  - Runways
  - Terminals
  - Warehouses

Airlines

Fixed-based operators
- Aircraft servicing
- Aircraft rental
- Aerial spraying

Federal facilities
- Air National Guard
- Air traffic control
- Airways facilities
- Armed forces
- Customs patrol
- Forestry Service
- Postal Service
- Weather Service

On-site aviation-related
- Advertising
- Aircraft manufacturing
- Aircraft radio repair
- Aircraft sales (retail)
- Airport inspection
- Airport parking
- Airport security
- Airport terminal services
- Automobile rental
- Aircraft parts manufacturing
- Avionics repair
- Barber shops
- Book stores
- Building maintenance/cleaning
- Coin-operated amusement
- Drinking places
- Drug stores
- Engine/propeller manufacturing
- Fire departments
- Flight insurance
- Flying clubs
- Florist shops
- Flying instruction
- Freight forwarding
- Food services
- Freight shipping
- Gift shops
- Hotels and motels
- News dealers
- Police departments
- Repair shops
- Restaurants
- Transit service
- Tobacco shops
- Travel agents

Source Transportation Research Board, National Research Council, Air Transportation Issues, Washington, D.C., 1987

Passenger Ground Transportation. This industry is concerned with the transportation of passengers to and from the airport, using modes of travel such as subway, bus, train, taxi, courtesy vans, and limousines. Jobs in this category include drivers, train operators, conductors, and mechanics. Most of these jobs require vocational training or a high school diploma.

Contract Construction and Consulting. Contract construction and consulting includes the initial and subsequent construction at the airport site, as well as on-demand consulting related to operational and planning aspects of the airport. Jobs include foremen, construction workers, heavy machinery operators, consultants, and managers. The educational requirements for consulting are somewhat greater than for contract construction. The former typically requires a minimum of a four-year university degree in a technical field, and advanced degrees are common. Except on the management side, the latter requires mostly high school diploma, or vocational training.

Financial and Business Services. This industry includes banks, lending institutions, financial advisors, investment houses, business consultants, and other services. Job types include managers, tellers, bankers, and accountants. Services are provided to travelers, airport and airline operators, and to clients within all the other industries listed in Table 5.1. The educational requirement for most of the jobs in this industry is a two- or four-year college degree, although for some positions a high school diploma is sufficient.

Food and Beverage. This category includes the production and provision of food and beverages, and includes catering services, vending machine operators, restaurants, and grocery stores (mostly indirect or induced impact). Job types include chefs, food preparation workers, waiters and waitresses, etc. Except for management, most positions in this industry require a high school diploma, although some jobs require vocational training.

Residential and Other Construction. Unlike the contract construction category described above, this industry is responsible for off-site construction. The job types and educational requirements are similar for both categories.

Apparel. This industry is concerned with the production, sale, and repair of apparel. Job types include fashion designers, tailors, shop owners, etc. For many jobs in this industry, a high school education is sufficient, although some positions require a two- or four-year college degree.

Transportation. This category includes all transportation of goods and passengers, except for air transportation and airport ground access transportation. Possible transportation modes include trucks, trains, and ships. Job types include drivers, merchant marines, cargo handlers, dispatchers, engineers etc. The majority of jobs within this category do not require college education, although some require vocational training.

Health Care. This industry provides health services to all employees impacted by the airport, as well as their dependents. Job types include surgeons, nurses, counsellors, secretaries, pharmacists, etc. The majority of jobs require two- or four-year college degrees, including advanced degrees such as Doctor of Medicine, or at least some vocational training.

Lodging and Amusement. This industry is concerned with providing lodging and entertainment to travelers and visitors to the region. Jobs in this category include hotel desk clerks, janitors, managers, attendants, ushers, etc. Most jobs in this industry require high school education or vocational training, although some positions require a two or four year college degree.

AIRPORT-RELATED INDUSTRIES

In order to further understand the types of jobs created by an airport, and the nature of the industries involved, a more refined set of categories can be used. For the indirect and induced impacts, the number of industries is vast, and hence the descriptions are limited to the industries directly impacted by airport development. Table 5.2 is a list of business activities that would be expected in an airport environment. This division of industries is based on RIMS (Regional Input-Output Modeling System) II categories, an economic model commonly used to determine the regional impact of aviation activities.

REGIONAL ECONOMIC BENEFITS OF NEW AIRPORT DEVELOPMENT

In addition to the economic impacts traditionally associated with airport activity such as those on personal income, job generation and taxes, there are numerous other benefits which would accrue to the local and regional economy if a SMA is constructed. Some of these benefits include increased airport capacity, a reduction in flight delays, increased economic development opportunities, increased tourism and convention activity, and a potential reduction in road user costs. Each of these benefit categories is discussed below.

Increased Economic Development Opportunities

The importance of an airport in attracting business and development to a region is widely recognized. A survey of major business executives conducted by Dow Jones in 1979 ranked the factors used to make business location decisions. As shown in Figure 5.5, air transportation is clearly a major factor affecting business location decisions. Developers also consider proximity to a major airport to be an important factor in selecting industrial sites.

Moreover, the development of a new airport is such a high profile project that it focuses attention on the region and can assist in attracting economic development. Case studies

Ranking of Importance for:

	Manufacturing Plant	Distribution Center	Regional Office	R & D Facility	Corporate Headquarters
Availability of Labor	1	4	6	4	5
Availability of Energy/Fuel	2	5	7	5	4
Availability of Raw Materials	1	4	6	4	5
Availability of Executive/ Professional Talent	11	12	3	1	3
Accessibility of Established Markets	4	2	4	10	10
Accessibility of New Markets	7	3	5	11	11
Highway Transportation Facilities	3	1	2	3	2
Rail Transportation Facilities	6	6	13	14	12
Air Transportation Facilities	13	7	1	2	1
Water Transportation Facilities	14	14	14	13	13
"Right to Work" Laws	8	8	8	7	9
Land Area	9	10	11	6	8
Tax Abatements/Incentives	10	9	9	8	6
Financing	12	11	10	9	7

Source: *Business on the Move, Dow Jones and Co., 1978.*

Figure 5.5

Factors Affecting Business Location Decisions

conducted at other new airports have shown that new airport development enhances the regional image, acts as a catalyst for economic growth and enables the region to compete more effectively with other geographic areas for economic development opportunities. Large airports serve as magnets for warehousing, distribution centers, office and industrial parks, research and development facilities, conference and international trade centers, hotels and other development.

Increased Capacity/Reduced Flight Delays

One of the most important benefits of new airport development is increased capacity. Based on the Logan Airport Demand Study conducted for Massport in 1988, Logan Airport is expected to experience considerable system stress by the year 2010. The increased capacity provided by an SMA would help to reduce flight delays and maintain a high level of safety at Logan, and increase the overall efficiency of the state's air transportation system.

The reduction in delays would benefit airlines, passengers and businesses. Airlines would benefit from a reduction in congestion delays which would result in lower aircraft operating costs (fuel, oil, crew and direct maintenance costs). Passengers would also benefit from reduced travel delays in terms of both convenience and time value. Vacationers would benefit from increased leisure time and business travelers would benefit from increased productivity. Since professionals generally charge for their services by the hour, a reduction in travel delays would decrease the cost of their services and increase their competitiveness in national and international markets.

As businesses depend heavily on fast, efficient air transportation for both executives and cargo, a reduction in flight delays would have positive effects both regionally and nationwide through increasing productivity and lowering the cost of doing business. Adequate air cargo capacity is critical in order for the region to maintain its competitive position in both the national and international trade arena. Many businesses depend on the timely shipment of inventory and finished goods to minimize inventory and warehousing costs. Constraints in air cargo capacity could result in the need to transport goods previously shipped by air via truck or rail, thus increasing delivery time and decreasing the competitiveness of both the shipper and the receiver. The New England Council study referenced earlier revealed that executives with high technology firms felt that congestion at Logan Airport hinders their competitive position in both national and international markets.

Increased Tourism and Convention Activity

Efficient air transportation is critical to the success of the tourism and convention industries. A SMA could allow the region to compete more effectively for tourism and convention activity. The added capacity provided by the SMA will allow for more frequent flights and lower air fares, making travel to the region more attractive to both

vacationers and convention groups. Case studies at other major airports show that congestion and flight delays have adversely affected tourism and convention activity. This decreased activity translates into a reduction in the potential economic benefits these industries can contribute to the region.

Reduced Road User Costs

The construction of a strategically located SMA could help to relieve congestion along access routes to Logan Airport and would also reduce travel distances for some travelers using the new airport. Less congestion and reduced travel distances would reduce the costs associated with traveling to and from the airport. These costs are known as road user costs and include fuel, operating and maintenance, depreciation and accident costs, as well as travel time costs. Passengers accessing a less congested or closer airport with their personal vehicles would benefit from reduced road user costs. Providers of ground transportation, such as taxicab drivers and bus drivers, would also experience lower road user costs, thus, increasing their profitability.

6. THE SITE SCREENING PROCESS

The central piece of the siting study has been the development of criteria for evaluating possible SMA sites. The diagram shown in Figure 6.1 illustrates the process by which the list of sites is being successively shortened. At each stage of the process the criteria which are used, and their method of application, is somewhat different. The steps which have been taken, and their content and method is described in detail in the following chapters. An overview of the process is provided below.

Steps 1 - 6 were carried out during Part A of the study, and are documented in this report. Steps 7 - 9 will be carried out in Part B and completed by April 1991.

Step 1 **Identification of all possible sites.**

- Review of Massachusetts Geographic Information System (MassGIS) land use information at a scale of 1"=8,000' to identify undeveloped areas (based on 1985 information).
- Collection of information about large parcels of land in single ownership from Federal, State and private sources.
- Identification of 182 possible sites

Step 2 **Development of basic site constraints**

1. Study area geographic limits
2. Avoidance of severely restricted air space
3. Avoidance of densely developed residential or commercial areas
4. Avoidance of major water bodies or areas which are primarily wetlands
5. Avoidance of areas of severe topography

Step 3 **Identification of the Inventory of Sites**

- Compilation of above noted information and second round review of the entire study area with United States Geological Survey information at a scale of 1"=2,000' based on basic site constraints.
- Selection of 32 inventory sites

Step 4 **Identification of Site Criteria to develop the Universe of Sites** (see Figure 6.2)

1. Aeronautical features:
   - Airfield capacity (10, 20 or 30 million annual passengers)
   - Airfield operations
2. Environmental features
   - Noise impacts on residential areas
   - Takings of park, recreation or conservation lands

Figure 6.1

Site Screening Process

STEP 1

INFORMATION COLLECTION

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85.....

150. xxxxxxxx

STEP 2

BASIC CONSTRAINTS

1. Market Area
2. Air space.
3. Dense residential and commercial development.
4. Major wetlands and water bodies.
5. Mountains.

STEP 3

INVENTORY

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50. xxxxxxxxxx

STEP 4

CRITERIA

1. Airfield capacity supported by site
2. Operational adequacy
3. Market catchment
4. Noise impacts
5. Parkland affected
6. Core parcel size

STEP 5

UNIVERSE

1. xxxxxxxxx
2. xxxxxxxxx
3. xxxxxxxxx
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STEP 6

KEY CRITERIA

1. Passenger capacity refined
2. Operational features refined
3. Market catchment - pax
4. Market catchment - cargo
5. Noise impacts refined
6. Parkland impacts refined
7. Wetlands, flood plains, water supply
8. Unique features
9. Land use compatability
10. Direct and Indirect economic impacts
11. Site acquisition and preparation costs
12. Infrastructure improvement costs
13. Site size
14. Transportation access

STEP 7

SHORT LIST

1. xxxxxxxxx
2. xxxxxxxxx
3. xxxxxxxxx
4. xxxxxxxxx
5. xxxxxxxxx

STEP 8

SITE STUDIES

- Diagrammatic airport layouts
- Capital cost estimates
- More refined noise impact profiles
- More refined land use compatibility profiles
- Site specific passenger and cargo catchment profiles

STEP 9

ACTION PLAN

1. Institutional Issues
2. Environmental Process
3. Schedule
4. Finance Strategies

→ Phase II
Second Major Airport
Site Selection Process

SECOND MAJOR AIRPORT SITING STUDY

Factor	Balanced Weight	Inputs
Aeronautical	30	airfield / passenger capacity; physical features affecting aircraft operations (layout, airspace conflicts, obstructions, weather)
Environmental	30	areas of non-compatible use (primarily residential) within the noise contour, areas of protected parkland, conservation and recreation land within the airport footprint
Market	25	passenger air travel market capture
Site	15	size of core parcel

Figure 6.2

Siting Criteria to Develop the Universe of Site

3. Market capture
   - Passenger draw (in 20, 30, 40 and 55 mile increments)
4. Site Features - core parcel size

- Development of a weighting scheme which gave the criteria the appropriate importance within the inventory screening process.
  - Aeronautical features - 30%
  - Environmental features - 30%
  - Market Capture - 25%
  - Site Features - 15%
- Sensitivity Tests

Step 5 **Screening of the inventory sites based on the criteria described above**

- Collection of data for each inventory site
- Evaluation of each site based on each of the criteria
- Development of a ranked set of sites
- Evaluation of critical issues: capacity to accommodate a Second Major Airport; avoidance of key protected resources (State Forests)
- Identification of 11 sites (Universe of Sites) worthy of further study

Step 6 **Identification of Site Criteria to develop the Short List of Sites** (see Figure 6.3)

1. Aeronautical features
2. Cost
3. Economic impacts
4. Environmental features
5. Compatibility with surrounding land uses
6. Market capture
7. Site features
8. Transportation characteristics

Step 7 **Screening of the sites to determine the short list of sites**

Step 8 **Preparation of detailed site studies for the short list sites**

Step 9 **Identification of future actions needed to identify, secure and implement a Second Major Airport and development of Growth Management tools for local communities**

Factor	Primary Inputs
Aeronautical	airfield / passenger capacity; physical features affecting aircraft operations (layout flexibility, airspace conflicts, obstructions, weather, wind)
Cost	estimated site acquisition, site preparation, construction, off-site improvement and infrastructure costs
Economic	permanent and construction jobs generated, on and off-site dollars generated, job relocation, projected (2010) local economic and employment conditions
Environmental	areas of non-compatible use (primarily residential) within the noise contour, areas of protected resources (parkland, conservation and recreation land) within the airport footprint, water resources, unique site features, air quality
Land Use Compatibility	airport fit with the present and projected land use pattern, potential residential, business, institutional relocation
Market	passenger air travel market captured, proximity to cargo distribution centers
Site	size of the core parcel, estimated total area of land which might be available for the airport, ease of site acquisition
Transportation	proximity to regional roadway network and railroad right-of-way

Figure 6.3

Siting Criteria to Develop the Short List of Sites

7. CREATION OF THE SITE INVENTORY

GENERAL METHODOLOGY

The site inventory for the Second Major Airport Siting Study was created through the identification of all the possible sites or locations that met a set of basic site factors. The sites and locations were identified through two processes:

1. Identification of possible locations through use of geographic overlays of constraints.

2. Identification of large parcels of land which were tested against the site constraints.

Described below are the constraints which guided the search for sites, and the means by which that search was carried out.

SITE CONSTRAINTS

Geographic boundaries for a possible SMA site were set as the area within approximately 45-60 minutes of Route 128, which is the approximate area within which a Second Major Airport will serve the demand for air travel. The boundaries stretched from Westover Air Force Base in Chicopee to the west (because of its status as an existing major airfield) to Cape Cod on the south, to the northern boundary of the state. A site further removed from the demand would not attract passengers and cargo and therefore would not be a viable major airport. A "travel time" map showing the general geographic area represented by this travel time limit was used to broadly define the region for which sites would be considered.

Once the basic geographic region was identified, minimum site criteria that would be applied to each of the identified inventory candidates were established. A series of overlay maps indicating areas which did or did not meet these criteria were developed. The maps included the following information:

- **Areas of dense residential development (density greater than approximately one dwelling unit per acre)**

  Siting of the airport in areas of dense residential development would result in significant negative impacts on people due to noise, would cause significant dislocation impacts, and would have extremely high site acquisition costs.

- **Areas of dense commercial development**

  Areas of dense commercial development were avoided due to noise, dislocation and acquisition costs.

- **Major wetlands and major waterbodies**

  The filling of wetlands and water bodies is strictly regulated by federal, state and local environmental agencies. Given the current regulatory and environmental climate, a site which necessitated very significant filling of wetlands, or was predominantly water, was deemed to be non-viable.

- **Mountains and severe topography**

  Mountains either within or adjacent to a site are obstructions to aircraft operations. Also, sites were not considered viable candidates for the inventory if half of the land area was composed of severe topographical features with grades greater than 20 percent. Such topography would result in very high cost site preparation.

- **Areas of severely restricted airspace**

  The single location of severely restricted air space in Massachusetts which had bearing on the inventory was Logan Airport. However, no potential sites were found which were within this restricted zone.

IDENTIFYING POSSIBLE SITES

Based on the initial assumptions regarding travel time and site criteria, sites were identified in two ways:

Identification of Large Parcels

Parcels of land in single ownership which were greater than 500 acres in size would provide a good "core parcel" in a tract of 1,500 or more acres, the minimum required for development of an airport handling 10 million annual passengers. Federal, state and county agencies and private realtors with jurisdiction over or knowledge of the study area were asked to provide listings of all known parcels of 500 acres or greater. A total of 30 public agencies were contacted and numerous real estate brokers were queried. 138 possible sites were identified by these agencies and brokers.

Possible Locations

Identification of possible sites which were not composed of at least one large parcel was the result of overlaying the constraint maps to identify general large areas or "windows of opportunity" in which none of the constraints were present. These locations were not identified on any of the public agency listings and the ownership required further research.

The identification of windows was carried out in two steps. First, geographic information provided by the Massachusetts Geographic Information System Office (within the Executive Office of Environmental Affairs) at a scale of 1"=8,000' was reviewed. With that very general information as a guide, a second round identification using United States Geological Survey (USGS) information at a scale of 1"=2,000' was conducted.

44 locations were identified in this manner.

CREATION OF THE INVENTORY

A compilation of 500+ acre parcels and windows of opportunity produced a set of 182 possible candidates (see Table 7.1 and Figure 7.1). The airport footprint and noise contour footprints were tested on each of the 182 sites on USGS topographical maps, by copying the footprints onto clear acetate and laying them over the site maps. The information provided on these maps includes significant environmental and physical features such as wetlands, waterbodies, topographical features, and residential and commercial development. This provided an understanding of whether any of the constraints described above existed within the airport footprints at each possible site. Each site which could accommodate one of the three airport footprints and avoid the site constraints described above was included in the inventory.

The footprints were also placed over plans of several existing out-of-state regional airports to determine their potential for expansion. Pease Air Force Base could accommodate Footprint 3; Bradley Airport in Connecticut and Manchester Airport in New Hampshire could accommodate Footprint 2; and Green Airport in Rhode Island could accommodate Footprint 1. Current and planned future activities at these airports are discussed in Chapter 3.

A total of 32 sites met the minimum constraints to be included on the inventory. These sites are shaded on Table 7.1.

#	Town	Name/Location	Approximate Core Parcel Size (if known)	Ownership (if known)
5	Abington	Ames Nowell State Park	607	Mass - DEM
6	Agawam	WMECO	582	private
7	Amesbury	Amesbury 495	550	private
10	Andover	River Road - mixed use	1,010	private
8	Andover	Harold Parker State Forest	2,134	Mass - DEM
9	Andover	Lowell Junction Industrial Park	520	private
11	Ashburnham	Ashburnham State Forest	534	Mass - DEM
12	Ashburnham	High Ridge Wildlife Mngt Area	2,558	Mass - FWE
157	Ashland	Location	646	
15	Barre	Barre Falls Reser.	539	federal
16	Barre	Tanner-Hiller Private Airport	132	
158	Bedford	Location	609	
17	Bedford/Concord/Lexington (C)	Hanscom Field	1,125	federal
18	Belchertown	Swift River Wildlife Mngt Area	600	Mass - FWE
19	Belchertown	State School	846	Mass
20	Beverly	Beverly Municipal Airport	425	
21	Billerica	ROW Parcel Rte. 3A (mult. sites)	20,700	Mass - DPW
22	Bourne	National Cemetery	750	federal
24	Bourne	Shawme Crowell State Forest	655	Mass - DEM
23	Bourne /Sandwich(D1)	Camp Edwards/Otis Air Force Base	22,000	
104	Bourne/Sandwich (D)	Otis Air Force Base/Camp Edwards	22,000	
136	Boxford	Location		
134	Boxford/North Andover/Middleton	Location		
25	Boylston	Wachusett Reservoir Watershed	6,096	Mass - MDC
164	Boylston/West Boylston	Worcester County site	572	Wrcstr Cnty
26	Bridgewater	MCI -Bridgewater	1,410	Mass - DOC
27	Brimfield	East Brimfield Lake	2,070	federal
28	Brimfield	Brimfield State Forest	2,454	Mass - DEM
29	Buzzards Bay	Cape Cod Canal	1,104	federal
30	Canton	Ponkapoag Golf Course	593	Mass - MDC
4	Carlisle	Great Meadows National Wil. Refuge	2,884	federal
32	Chicopee (E)	Westover Air Force Base	2,677	federal
33	Cohasset	Wompatuck State Forest	2,801	Mass - DEM
34	Concord	Minute Man National Hist. Site	745	federal
154	Dartmouth	Location		
35	Dartmouth	Southeastern Mass. University	705	Mass - BOR
	Dartmouth/New Bedford/Freetown (K)	Acushnet Cedar Swamp State Reservation		Mass - DEM
143	Dighton/Rehobeth	Location		
150	Douglas/Uxbridge (G)	Location	588	private
36	Douglas/Webster/Oxford (F)	Douglas State Forest	3,752	Mass - DEM
155	Dover	Location		
137	Dracut/Methuen	Location		
37	Easton	Oakes Ames Memorial Park	594	Mass - DEM
38	Erving	Erving State Forest	1,894	Mass - DEM
39	Erving	Northfield State Forest	510	Mass - DEM
33	Essex/Glouchester/Manchester	Location		
40	Fall River	Fall River Municipal Airport (50 acres)		
41	Fall River/Freetown (H)	Acushnet Sawmill	1,000	private
	Fall River/Westport/Dartmouth (I)	Location		
42	Falmouth	Crane Fish & Wildlife Preserve	1,006	Mass - FWE
43	Falmouth	Falmouth Airport (private)	22	
44	Fitchburg	Fitchburg Municipal Airport	375	

Note: Inventory sites are shaded.

Table 7.1

Complete Listing of all Sites Reviewed

#	Town	Name/Location	Approximate Core Parcel Size (if known)	Ownership (if known)
45	Foxborough/Wrentham	F. Gilbert Hills State Forest	593	Mass - DEM
159	Framingham	Location	940	
	Franklin/Bellingham (J)	Franklin State Forest	413	Mass - DEM
46	Freetown	Freetown State Forest	3,378	Mass - DEM
152	Freetown/Lakeville (H1)	Location	450	private
47	Gardner	Gardner Municipal Airport	80	
48	Georgetown	Georgetown-Rowley State Forest	556	Mass - DEM
49	Georgetown	Georgetown 95 mixed use	510	private
51	Groveland	Salem Street mixed use	625	private
52	Hamilton	Bradley Palmer State Park	550	Mass - DEM
53	Hanson	Cranland Airport (private)		
54	Harvard	Oxbow Nat. Wildlife Refuge	711	federal
65	Harvard/Lancaster/Shirley (A)	Fort Devens (south of Rte. 2)	5,000	federal
14	Harvard/Shirley/Lancaster/Ayer (B)	Fort Devens (north of Rte 2)	5,000	federal
55	Haverhill	Haverhill-Riverside Airport (pri.)	11	
56	Haverhill	Ward Hill Industrial Park	725	private
57	Hingham	USARC Hingham	767	federal
58	Holyoke	Probably Mt Skinner or Mt Tom	3,839	MDC,DPW
59	Hopedale	Hopedale-Draper Airport (private)	40	
	Hopedale/Upton/Mendon (N)	Location		
61	Hopkinton	Whitehall State Park	832	Mass - DEM
60	Hopkinton (with #141)	Hopkinton State Park	717	Mass - DEM
141	Hopkinton (with #60)	Location		
62	Hubbardston	Hubbardston Wildlife Mngt Area	1,297	Mass - FWE
96	Hubbardston	Hubbardston State Forest	8,070	Mass - DEM
	Hubbardston (DD)	Location		
63	Hubbarston	Ware River Watershed (mult. sites)	1,427	Mass - MDC
64	Ipswich	Willowdale State Forest	1,535	Mass - DEM
151	Lakeville	Location		
66	Lancaster	MCI - Lancaster/Surplus Property	625	Mass - DOC
67	Lancaster	State Industrial School for Girls	517	Mass - DYS
68	Lawrence	Lawrence Municipal Airport	440	
139	Leominster/Princeton	Location		
69	Manchester	Manchester 128	689	private
166	Manchester, NH	Manchester Airport		
70	Mansfield	Mansfield Municipal Airport	252	
71	Marlboro	Marlboro Airport (private)	28	
72	Marshfield	Marshfield Airport	81	
73	Medford	Middlesex Fells Reservation	1,057	Mass - MDC
148	Mendon/Uxbridge/Millville/Blackstone (L)	Location		
164	Middleboro/Bridgewater/Halifax (M)	Location	713	private
144	Middleboro/Rochester	Location		
74	Middleborough	Rocky Gutter Wildlife Mngt Area	745	Mass - FWE
75	Monson	Monson Developmental Center	681	Mass - DMR
76	Montague	Turners Falls Airport	227	
77	New Bedford	New Bedford Municipal Airport	847	
78	New Braintree	MCI - New Braintree	782	Mass - DOC
3	Newbury	Parker River Nat. Wild. Refuge	4,662	federal
79	Newbury	Martin Burns Wildlife Mngt Area	815	Mass - FWE
80	Newbury	Parker River Wildlife Mngt Aera	1,085	Mass - FWE
81	Newburyport	Plum Island Airport (private)	30	
82	Norfolk	MCI - Norfolk	1,053	Mass - DOC

Note: Inventory sites are shaded.

# •	Town	Name/Location	Approximate Core Parcel Size (if known)	Ownership (if known)
83	Norfolk	Norfolk Airport (private)	200	
84	Norfolk County	Charles River ONVS (mult. sites)	3,209	federal
85	Northampton	Northampton Airport (private)		
86	Norton	Rich Kraska Property	1,000	private
87	Norwood	Norwood Memorial Airport	438	
88	Oakham	Quabbin Aqueduct (multiple towns)	2,061	Mass - MDC
89	Orange	Orange Municipal Airport	550	
91	Palmer	Metropolitan Airport (private)	100	
92	Pelham	Cadwell State Forest	1,195	Mass - DEM
93	Pelham	University of Massachusetts	1,110	Mass - BOR
94	Pepperell	Sports Center Airpt (private, 103 acres)		
	Pepperell/Townsend	Location		
95	Petersham	Federation State Forest	586	Mass - DEM
146	Plymouth	Location		
97	Plymouth	Plymouth Municipal Airport	734	
98	Plymouth (P)	Digital Site	3,600	DEC
	Plymouth(Q)	Location		
153	Plymouth/Bourne (S)	Location		
31	Plymouth/Carver (R)	Myles Standish State Forest	4,748	Mass - DEM
	Plymouth/Wareham/Carver (R1)	Location		
165	Portsmouth, NH	Pease Air Force Base		
99	Princeton	Mt. Wachusett Reservation	1,719	Mass - DEM
147	Princeton/Rutland (T)	Location		
164	Providence, R.I.	Green Airport		
100	Randolph/Quincy/Milton	Blue Hills Reservation	860	Mass - MDC
145	Rochester	Location		
101	Rowley	Rowley Commercial	540	private
13	Royalston	Tully Lake	1,271	federal
102	Royalston	Birch Hill Dam	3,786	federal
103	Royalston	Millers River Wildlife Mngt Area	1,687	Mass - FWE
	Royalston (CC)	Location		
105	Sharon	Borderland State Park	773	Mass - DEM
	Sharon/Stoughton/Easton (U)	Location		
106	Shirley	Shirley Airport (private)	75	
107	Southbridge	Southbridge Municipal Airport	229	
108	Spencer/Paxton	Andrews Aviation (private, 14 acres)		
109	Sterling	Sterling Airport (private)	100	
160	Stoughton	Location	534	
110	Stow	Minute Man Airfield (private)	100	
111	Sturbridge	Wells State Park	687	Mass - DEM
131	Sturbridge	Westville Lake	577	federal
112	Sunderland	Mount Toby State Forest	676	Mass - DEM
113	Sutton/Northbridge (V)	adj. to Sutton State Forest/Purgatory Chasm	506	Mass - DEM
90	Sutton/Oxford/Millbury/Auburn (O)	around Oxford Airport (private, 23 acres)		
114	Taunton	Massasoit State Park	1,302	Mass - DEM
116	Taunton	Taunton Municipal Airport	241	
115	Taunton	Paul A. Dever State School	945	Mass - DMH
142	Taunton/Raynham	Location		
117	Templeton	Walter E. Fernald School	1,627	Mass - DMR
118	Tewksbury	Tew-Mac Airport (private)	75	
121	Townsend	Willard Brook State Forest	660	Mass - DEM
119	Townsend	State Forest	600	Mass - DEM

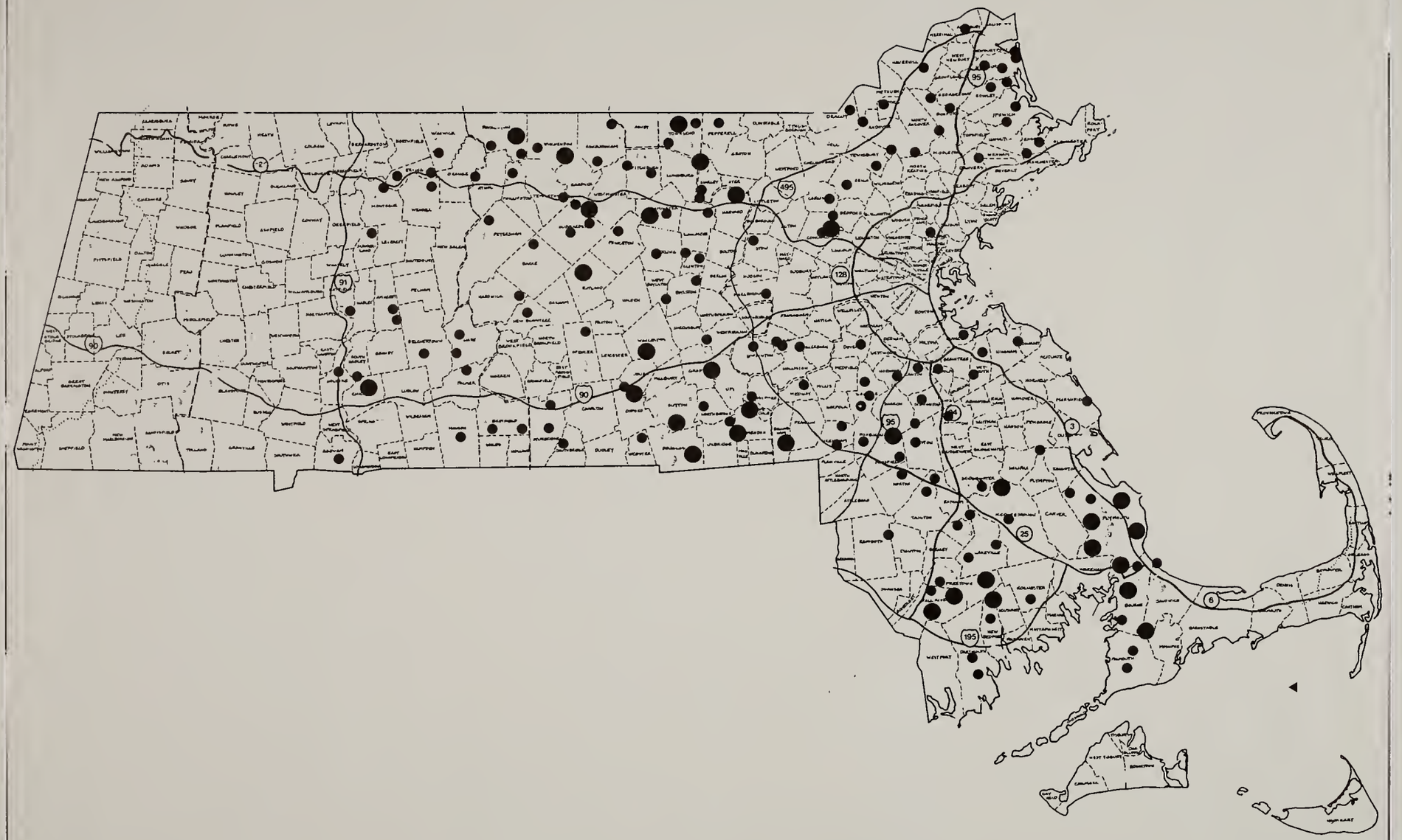
Note: Inventory sites are shaded.

#	Town	Name/Location	Approximate Core Parcel Size (if known)	Ownership (if known)
120	Townsend/Mason, N.H. (W)	Townsend State Forest	2,710	Mass - DEM
138	Townsend/Shirley/Lunenburg (Y)	Location		
	Upton/Grafton/Hopkington (AA)	Upton State Forest	2600	Mass - DEM
122	Uxbridge	West Hill Dam	557	federal
161	Wakefield	Location	598	
162	Walpole	Location	589	
123	Walpole	Walpole	516	private/town
124	Ware	Quabbin Watershed	2,154	Mass - MDC
125	Warwick	Warwick State Forest	6,635	Mass - DEM
149	Webster	Location		
126	Wendell	Wendell State Forest	1,339	Mass - DEM
140	Westborough/Grafton/Upton	Location		
127	Westminster	MCI -Gardner	716	Mass - DOC
163	Weymouth	Location	1,410	
128	Weymouth	So. Weymouth Naval Air Station	2,101	federal
	Winchendon (BB)	Location	489	private
129	Winthrop	Shore Drive	1,305	Mass - MDC
130	Worcester/Leicester (Z)	Worcester Municipal Airport	720	
132	Wrentham	Wrentham State Forest	1,638	Mass - DEM
133	Wrentham	Wrentham State School	1,100	Mass - DMH

Note: Inventory sites are shaded.

Figure 7.1

All Sites Reviewed for the Study



● Inventory Sites
• Other sites

Note: All locations are approximate

0 20 miles

SECOND MAJOR AIRPORT SITING STUDY

8. DEVELOPING THE UNIVERSE OF SITES

Following the identification of the 32 inventory sites, the next step in the study was the screening of these sites to determine which of them should be studied in greater detail. As described earlier, six criteria were used to evaluate the 32 sites. The method by which the sites were screened, and the results of that screening, are described below.

SCREENING METHOD

In order to assimilate the large amount of information which was collected for each of 32 sites, a numerical ranking system was developed for the screening process. The scores which were developed were used as a tool for evaluating the sites; the method by which the scores were given to each site is described below for each of the six factors. For purposes of evaluating the sites, the four general categories shown in Figure 6.2 were divided into six more detailed ones. Aeronautical features were divided into airfield capacity and operations; and environmental factors were divided into noise impacts and impacts to protected resources.

Each of the sites was given a score of 1 - 5 (1 being the worst score and 5 the best) for each of the six screening factors. The scores for each site were totaled (based on the weights of the different factors), and the overall scores were than compared.

The rankings developed during this first phase of the study will not be used any further. A more detailed look at each of the sites identified for further evaluation, relative to the evaluation factors described below as well as additional factors, will be conducted during Part B of the study.

AIRFIELD CAPACITY

Airfield capacity ranks were based on the airport footprint which fit on the site. Those sites which accommodated Footprint 3 (two independent, parallel runways) were given a score of 5; those sites which accommodated Footprint 2 (two dependent, crosswind runways) were given a score of 3; those sites which accommodated Footprint 1 (one 10,000 foot runway) were given a score of 1.

Nine sites were given a score of 5.
Eleven sites were given a score of 3.
Twelve sites were given a score of 1.

AIRFIELD OPERATIONS

The operational aspects of an airport site which were reviewed during this phase of work included weather and wind, interference with existing airports, flexibility, and significant obstructions.

In order to obtain a score which reflects all of these issues, it was decided to score each issue individually, and then use a weighted sum to obtain a final score. The weights reflect the relative significance of each of the issues at this stage of the screening process.

Weather and Wind When the analysis of wind and weather was initiated, it became clear that there was not adequate information to differentiate among the sites with the information available at this level of inquiry. Therefore, the consideration of weather and wind was eliminated from the preliminary operational analysis of the Inventory sites.

Interference with Existing Airports The potential interference of a new major airport with existing airports was considered by constructing and examining hypothetical approach and departure paths for each site. At this preliminary stage of the operational analysis, only conflicts with existing major air carrier airports (Logan International Airport), regional or commuter airports (Green Airport, Manchester Airport, Bradley International Airport, Pease Air Force Base), and general aviation (GA) airports with Instrument Landing System approaches (Nashua Airport, Hanscom Field, New Bedford Airport, Worcester Airport, Hyannis Airport) were considered. Approach and departure procedures, including Standard Instrument Departures (SIDs) and Standard Approach Routes (STARs) were considered. The approach and departure paths were assumed to be straight line segments with lengths of 20 nm (nautical miles), 15 nm, and 10 nm for major airports, regional airports, and GA airports respectively. The scoring scheme displayed in Table 8.1 was employed to assign a score ranging from 5 to 1 for each potential SMA site.

Table 8.1. Interference Scoring Scheme

Level of Interference	GA Airport	Regional Airport	Major Airport
None or Very Little	5	5	5
Some Possible	4	4	3
Some Likely	4	3	2
Definite	3	2	1

Significant Obstructions Information on significant obstructions was derived from FAA sectional and other charts. Obstructions to approach and departure paths include buildings, smoke stacks, antennas, bridges, hills, and mountains. At this level of analysis, obstructions within a 10 nautical mile radius of each potential site were considered. The scoring scheme shown in Table 8.2 was used as a guide. It should be noted that certain obstructions, especially man-made ones, can be removed in the interest of constructing a Second Major Airport. However, if several "removable" obstructions are affected, removal and relocation costs could be considerable.

Table 8.2. Obstruction Scoring Scheme

Score	Interpretation
5	No obstruction
4	Possible obstruction
3	Multiple removable obstructions
2	Permanent obstructions < 500 ft AGL*
1	Permanent obstructions > 500 ft AGL*

*AGL - Above Ground Level

Flexibility The runway configuration available at an airport at any given time is primarily a function of weather, particularly wind speed and heading. If an airport site is constrained, such that only one runway direction can be used (e.g. one runway, or two parallel runways with no crosswind runway), there may be times when the crosswind component is so severe, that the airport must be closed. The existence of crosswind runways provides operational flexibility. Increased flexibility allows the airport to be available even during inclement wind conditions, and simplifies issues such as runway maintenance. The existence of independent parallel runways also increases operational flexibility, although it does not improve crosswind related flexibility.

As defined above, flexibility is primarily a function of the size of the site. If the site is large enough to accommodate a set of independent parallel runways (Footprint 3), and at least one full length crosswind runway, it should not experience any significant problems from the standpoint of operational flexibility. It has been determined previously that such a configuration would require approximately 5,000 acres. If the site can only accommodate a set of crosswind runways (Footprint 2: approximately 3,000 acres available), the flexibility is clearly constrained. However, this case is still better than the least flexible case - a site which can only accommodate one full length runway (Footprint

1: approximately 1,500 acres available). Using this methodology, the scoring method displayed in Table 8.3 was employed.

Table 8.3. Flexibility Scoring Scheme

Score	Interpretation
5	Independent Parallels with Crosswind
3	Dependent Crosswind Runways
1	Single Runway Only

Evaluation

The analysis presented above results in three individual scores for each site. In order to assign a single score reflecting operational aspects, a weighting scheme was devised. The following scoring method was used for this preliminary analysis.

Operation Score = 50% Interference Score + 10% Obstruction Score + 40% Flexibility Score

This formulation emphasizes the importance of airspace interference and flexibility concerns. Obstruction problems can often be overcome, either through modifications of the flight path or through removal of the obstructions. Interference with existing airports is judged to be a slightly more important problem than operational flexibility. This is particularly true for Massachusetts, where even a single runway configuration is expected to have high availability due to the prevailing westerly winds. The individual and overall operations scores of each site are shown in Table 8.4.

Table 8.4. Operations Scores

Site		Rankings Interference	Obstructions	Flexibility	Overall
A	Fort Devens South	3	4	5	4
B	Fort Devens North	3	4	5	4
C	Bedford Hanscom Field	1	5	1	1
D	Otis AFB	5	5	5	5
E	Westover AFB	2	5	3	3
F	Douglas State Forest	3	3	5	4
G	Douglas/Uxbridge	3	3	5	4
H	Fall River/Freetown	3	5	5	3
I	Fall River	3	5	5	3
J	Franklin State Forest	5	5	3	4
K	Freetown	3	5	3	3
L	Mendon	4	2	5	4
M	Middleborough	3	5	5	4
N	Milford/Hopedale	4	3	1	3
O	Oxford Airport	3	3	1	2
P	Plymouth (DEC Site)	4	2	5	4
Q	Plymouth	3	5	3	3
R	Plymouth/Carver	4	5	5	4
S	Plymouth/Bourne	5	5	3	4
T	Princeton/Rutland	5	3	1	3
U	Sharon	3	5	1	2
V	Sutton State Forest	3	5	1	2
W	Townsend State Forest	5	5	1	3
Y	Townsend/Shirley/Lunenberg	4	4	1	3
Z	Worcester Airport	5	3	1	3
AA	Upton State Forest	3	3	3	3
BB	Winchendon	5	3	3	4
CC	Royalston	5	3	1	3
DD	Hubbardston	5	3	1	3

NOISE IMPACTS

The Ldn 65 noise contours for 1990 were applied to each of the Inventory Sites as sketched on USGS maps. For Footprints 2 and 3 noise, contours were examined in all four directions from the site. For Footprint 1 (single runway sites), noise was examined only in the direction of the single runway.

For each site, an estimate was made of the housing density (low, medium or high) and the percent of the area within the contour which was occupied by such housing.

The method for developing a score for each site was as follows. Values were assigned for estimated housing density with low density = 1, medium = 2, and high = 3. These values

were then multiplied by the estimated percentage of the noise contour which was occupied by housing of each density. The scores for the sites were assigned as shown below.

5 = 0 -7 points
4 = 8 - 15 points
3 = 16 - 24 points
2 = 25 - 32 points
1 = 33+ points

For example, at Site BB in Winchendon, 2% of the WNW quadrant was low density residential, less than 1% of the ESE quadrant was low density scattered residential, less than 1% of the NNE quadrant was low density scattered residential and 5% of the SSW quadrant was low density residential. The calculations based on this information ({1 x 2} + {1 x 5} + {1 x 1} + {1 x 1}/4) result in a total score of 2. Based on the chart above, this translates into a final ranking of 5.

Thirteen sites were given a score of 5.
Nine sites were given a score of 4.
Three sites were given a score of 3.
No sites were given a score of 2.
Seven sites were given a score of 1.

IMPACTS ON PARK, CONSERVATION AND RECREATION AREAS

The impacts on state and federally protected resources (park, recreation, or conservation areas) were examined for each site on the basis of information available on USGS maps. These resources are protected by a variety of state and federal regulations, including Section 4(f) of the Department of Transportation Act of 1966, which prohibits the use of such properties unless no prudent and feasible alternative can be found. These sites are also protected under Massachusetts General Law Chapter 97, which requires a 2/3's vote of the Legislature to alter the use of state-owned park and recreation areas. Protected resources within the footprint of the airport and directly adjacent to the footprint were evaluated.

Scores were assigned on the following basis.

5 = No protected resources on or immediately adjacent to the site.
4 = Protected resources immediately adjacent to the site.
3 = A small area of protected resources on the site.
2 = A substantial area of protected resources on the site.
1 = Most of the site composed of protected resources.

Twelve sites were given a score of 5.
Eight sites were given a score of 4.
Five sites were given a score of 3.
Five sites were given a score of 2.
Two sites were given a score of 1.

MARKET CAPTURE

One of the criteria considered in evaluating the sites was the location of the sites relative to the potential air travel demand. Estimating the future market for a new airport is not a simple process. The Massport regional demand data used for this study (described below) is exceptionally detailed data for this level of evaluation and provided a very good base for the market capture evaluation. In addition to demand for air travel services, the potential market also depends upon a number of other factors, including the accessibility of the proposed site to the prospective users, and the competition provided by other commercial airports in the region. These factors will be incorporated during the market assessment prepared during Part B of the study.

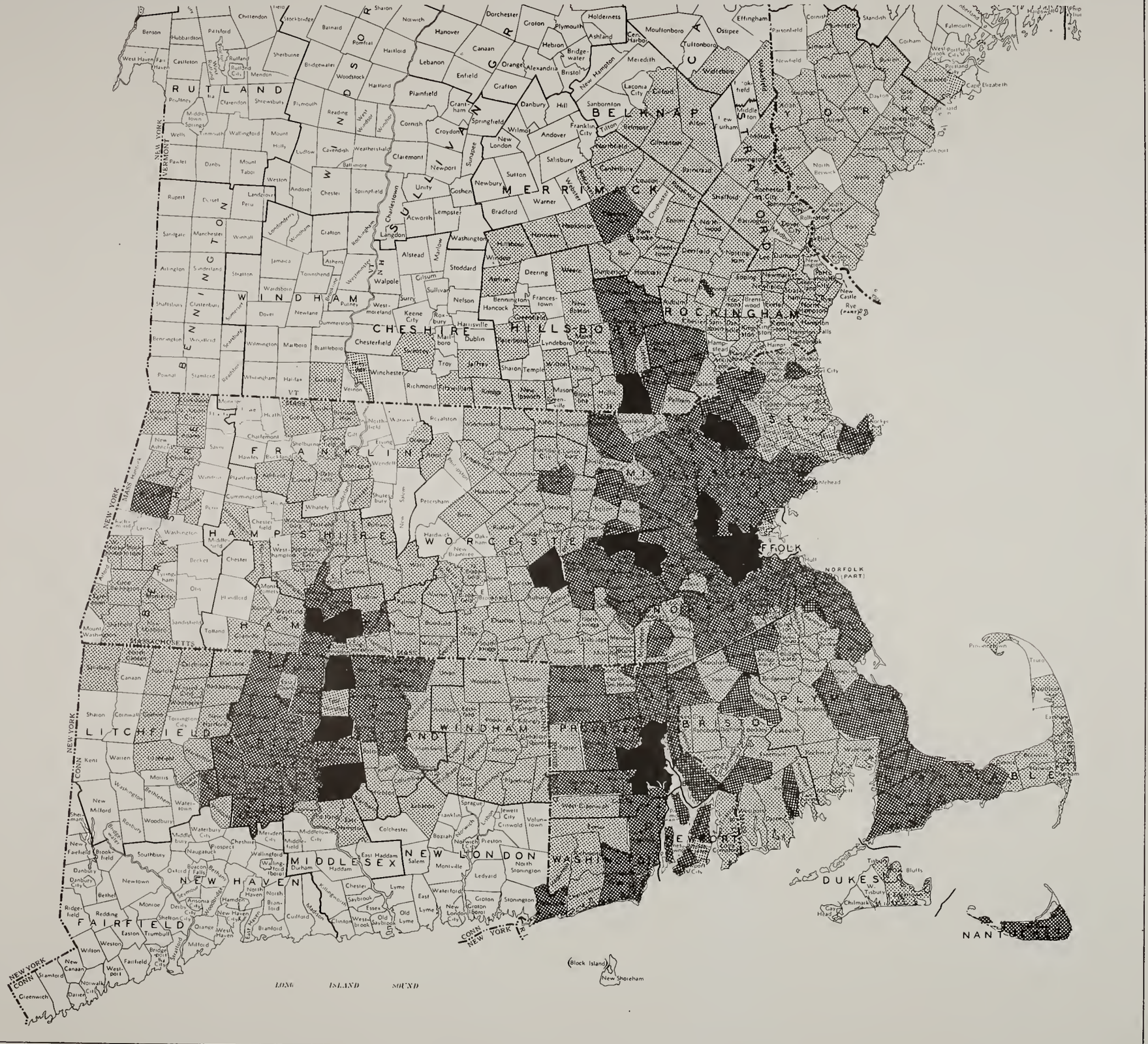
Methodology For the preliminary market analysis of the Inventory sites, data developed for Massport has been used to estimate the number of air passengers whose origin or destination is within a specified distance from each of the possible sites. By repeating the process for different distances, the potential passenger demand within larger and larger circular "catchment areas" has been estimated. If accessibility and competition were equal (and the only criterion being considered was demand), the site with the largest demand in the smallest catchment area would be preferable in terms of potential passenger market.

The total air passenger demand has been forecast for the year 2010 for each town in Massachusetts as well as adjacent areas of Rhode Island, northern Connecticut, southern New Hampshire, southern Maine and southern Vermont (see Figure 8.1). The market data is total projected demand for the year 2010. It does not identify which airport passengers might use (e.g., Logan, Green, Bradley, Manchester, etc.). It was prepared by using reported socioeconomic data, including population, personal income, employment, and hotel rooms, and estimated future changes in these variables as well as for air fares. Separate forecasts were produced for passenger trips in four categories: Resident Business, Resident Non-Business, Nonresident Business and Nonresident Non-Business. The total projected demand was calculated as the sum of these four categories for each town.

Preliminary Market Results To compare the Inventory sites, four circular "catchment areas" were designated, with radii of 20, 30, 40 and 55 miles. The number of the 2010 forecast passenger trips from towns within each catchment area was added, and the result was divided by the total of all the trips to obtain a percentage of the entire regional

Figure 8.1

Annual Passenger Trip Demand: 2010 Forecast



market. At each site the percent of all regional passenger trips beginning or ending within a specified distance was determined.

For example (see below), only 14.7% of all forecast trips for the region would originate or terminate within a 20-mile radius of Site A, while 57.9% of the regional trips would begin or end within a 30-mile radius of Site A. As the catchment circle expands to 40 and 55 miles, the number of all forecast trips beginning or ending at towns within this catchment area increases to 65.4% and 69.8% respectively.

	Catchment (% of Total Trips)			
	20 miles	30 miles	40 miles	55 miles
Site A	14.66%	57.87%	65.41%	69.78%

In order to apply the results of the market catchment assessment to the Inventory site screening, scores ranging from 5 - 1 were assigned to each site. The results of the market catchment analysis at each of the four radii (20, 30, 40 and 55 miles) vary sufficiently among the sites to allow assignment of different scores. For each radius increment, there is a cluster of sites with catchment levels approximating 50%. Those sites with a significant market catchment within the 20 mile radius were given a score of 5. At the next radius, 30 miles, sites with market catchment levels near or above 50% received a score of 4. Sites which reach the 50% level at a radius of 40 miles were given a score of 3. Those sites which have a significant share at 55 miles were given a score of 2. The remaining sites which do not reach market catchment levels near 50% even at a 55 mile radius were given a score of 1 (see Table 8.5).

Based on the analysis:

One site was given a score of 5.
Six sites were given a score of 4.
Eleven sites were given a score of 3.
Thirteen sites were given a score of 2.
One site was given a score of 1.

Table 8.5 Market Comparison of SMA Inventory of Sites for 2010

Site		Catchment (% of Total Trips) 20 mi	30 mi	40 mi	55 mi
A	Fort Devens South	14.66	57.87	65.41	71.23
B	Fort Devens North	22.09	54.75	65.71	70.57
C	Bedford Hanscom Field	46.27	60.21	66.27	71.08
D	Otis AFB	2.48	6.01	15.86	60.02
E	Westover AFB	5.62	8.81	11.39	21.18
F	Douglas State Forest	2.83	9.43	22.35	58.64
G	Douglas/Uxbridge	3.34	9.67	22.91	64.97
H	Fall River/Freetown	1.85	7.76	17.82	59.99
I	Fall River	1.76	6.75	17.71	56.70
J	Franklin State Forest	10.54	20.53	56.95	73.79
K	Freetown	2.45	11.52	22.05	63.04
L	Mendon	8.07	17.37	31.00	72.15
M	Middleborough	10.17	45.67	60.58	72.07
N	Milford/Hopedale	13.69	23.21	58.72	73.01
O	Oxford Airport	3.92	11.93	24.66	67.30
P	Plymouth (DEC Site)	5.33	35.53	60.22	71.82
Q	Plymouth	4.37	16.42	58.83	71.01
R	Plymouth/Carver	4.84	18.71	58.08	70.52
S	Plymouth/Bourne	3.05	11.18	45.82	67.16
T	Princeton/Rutland	4.98	17.62	55.29	69.92
U	Sharon	19.35	54.95	63.75	74.05
V	Sutton State Forest	6.49	16.42	27.58	71.40
W	Townsend State Forest	6.10	50.18	59.74	69.06
Y	Townsend/Shirley/Lunenberg	5.27	49.72	63.78	70.67
Z	Worcester Airport	4.72	15.56	27.82	69.97
AA	Upton State Forest	13.41	24.65	58.88	72.97
BB	Winchendon	1.04	6.77	53.33	69.32
CC	Royalston	0.74	4.84	20.26	66.71
DD	Hubbardston	3.84	13.53	47.77	69.35

CORE PARCEL SIZE

Core parcel size is an assessment of the level of consolidated ownership which exists on the site. Several sites are in one unified ownership (e.g., the federal government), while a number are owned by hundreds of different people. The ease of acquisition of possible sites will be based (to some extent) on the complexity of the ownership pattern. Ownership was determined through examination of local tax maps which indicate the parcelization of land.

Scores for the sites were given as follows:

5 = At least one parcel 3,000+ acres in size
4 = Largest parcel 2,000 - 3,000 acres
3 = Largest parcel 1,000 - 2,000 acres
2 = Largest parcel 450 - 1,000 acres
1 = No parcel larger than 450 acres

Six sites were given a score of 5.
Four sites were given a score of 4.
Four sites were given a score of 3.
Eight sites were given a score of 2.
Ten sites were given a score of 1.

RESULTS

Each of the sites was given scores for each of the six factors as described above. Table 8.6 shows these scores. The scores were then tallied based on the weighting of each of the factors which had been developed to reflect their relative importance in the site evaluation. With this method, the sites could be reviewed relative to each other in terms of how well they met each of the criteria.

The balanced analysis (based on a total of 100 points) assigned weight as shown below. The weighting scheme was based on the input of all of the participants in the study, and thus reflects a wide range of technical expertise and policy perspectives.

Aeronautical capacity	17
Aeronautical operations	13
Market capture	25
Noise impacts	19
Park impacts	11
Size of core parcel	15
Total	100 points

In addition to the balanced weighting, three sensitivity tests were performed which assigned greater weight to :

1. Aeronautic features
2. Market capture
3. Environmental factors

The sensitivity tests were carried out to make sure that sites which were particularly good or poor on any specific criterion did not end up with an inappropriate overall

	see map	Town	Airport Footprint Fit 1=1500 acres 2= 3000 acres 3=5000 acres	Name/Location	Rank Airfield Capacity (note 1)	Rank Opera-tions	Rank Noise	Rank Protect Resource (note 2)	Rank Market	Rank Core Parcel Size		Balanced Weight	Aero. Greater	Market Greater	Env. Greater	Sum of Scores
	UNIVERSE OF SITES															
1	A	Harvard/Lancaster/Shirley	3	Fort Devens (south of Rte. 2)	5	4	5	4	4	5		90	90	89	91	360
	B	Shirley/Harvard/Lanc./Ayer	3	Fort Devens (north of Rte 2)	S	4	4	4	4	5		86	87	86	86	345
	D	Bourne/Sandwich	3	Otis/Camp Edwards	5	5	5	5	2	5		85	87	79	87	339
	D1	Bourne/Sandwich	3	Camp Edwards/Otis	5	5	4	5	2	5		81	84	76	82	324
	P	Plymouth	3	Digital Site	5	4	4	5	3	4		81	82	78	82	323
	M	Middleboro/Bridgewtr/Halifax	2	Location	3	4	5	5	4	2		77	75	77	80	309
	G	Douglas/Uxbridge	3	Location	S	4	4	S	2	2		70	73	66	72	281
	BB	Winchendon	2	Location	3	4	5	4	3	2		69	69	68	73	279
	H	Fall River/Freetown	2	Acushnet Sawmill	3	4	5	3	2	3		65	66	62	68	260
	H1	Freetown/Lakeville	2	Location	3	4	5	4	2	2		64	65	61	68	259
	Q	Plymouth	2	Location, small pri. parcels	3	3	4	5	3	1		62	62	62	66	252
	SITE IS PRIMARILY PARKLAND															
1A	R	Plymouth/Carver	2	Myles Standish State Forest	3	4	5	1	3	5		72	71	70	71	284
	F	Douglas/ Webster/Oxford	3	Douglas State Forest	5	4	3	2	2	4		65	69	62	64	260
	AA	Upton/Grafton/Hopkinton	2	Upton State Forest	3	3	4	2	3	4		65	64	64	65	257
	J	Franklin/Bellingham	2	Franklin State Forest	3	4	5	2	3	1		62	63	61	64	250
	LOW RANKING INVENTORY SITES															
2	I	Fall River/Westport/Dartmouth	3	Location	5	4	1	5	2	2		58	63	56	57	235
	L	Mendon/Uxbr./Millvl./Blackstn.	3	Location	S	4	1	5	2	1		55	61	54	55	224
	S	Plymouth/Bourne	2	Location	3	4	1	5	3	1		53	56	55	53	217
	K	Dartmouth/New Bed./Freetown	2	Acushnet Cdr. Swp. St. Res.	3	3	3	2	2	2		50	51	48	50	200
	E	Chicopee	2	Westover Air Force Base	3	3	1	3	1	4		45	48	42	44	180
	ONE 10,000' RUNWAY															
3	W	Townsend/Mason NH	1	Townsend State Forest	1	3	5	1	4	5		67	63	69	67	266
	DD	Hubbardston	1	Location	1	3	5	5	3	3		65	61	64	70	261
	T	Princeton/Rutland	1	Location	1	3	5	5	3	1		59	56	59	65	239
	Y	Townsend/Shirley/Lunenburg	1	Location	1	3	4	4	4	1		58	55	61	61	235
	CC	Royalston	1	Location	1	3	5	4	2	2		55	52	53	60	220
	C	Bedford/Concord/Lexington	1	Hanscom Field	1	1	1	4	S	3		53	48	59	51	211
	N	Hopedale/Upton/Mendon	1	Location	1	3	4	3	3	1		51	49	52	54	206
	R1	Plymouth/Wareham/Carver	1	Location	1	3	3	2	3	3		51	49	52	51	203
	V	Sutton/Northbridge	1	adj. Sutton St Fst/Purg Chsm	1	2	5	3	2	1		47	44	46	52	190
	U	Sharon/Stoughton/Easton	1	Location	1	2	1	4	4	1		44	42	49	44	179
	O	Sutton/Oxford/Millbury/Auburn	1	around Oxford Airport (pri.)	1	2	4	3	2	1		43	41	43	47	175
	Z	Worcester/Leicester	1	Worcester Mun. Airport	1	3	1	5	2	2		42	42	42	43	169

Notes: 1 - Rank 5 = best...Rank 1 = worst
2 - Protected Resources based on USGS quad map information

Table 8.6
Ranked Inventory of Sites

valuation. The sensitivity tests also help to insure that the balanced weighting scheme does not unintentionally skew the results too heavily based on any one factor.

Based on the balanced weighting, site scores ranged from 90 to 42 (out of a possible 100 points). The sensitivity tests revealed little variation in scores, and very little variation in the relative ranking of the sites. The consistency of rankings with varied weighting schemes indicates that the top ranking sites scored high in all categories and supports the selection of these sites for further analysis.

The evaluations were all performed on a relative basis among sites. As each site was evaluated it became clear that there were clear distinctions among the sites, with some having significantly greater drawbacks than others. Table 8.6 indicates the rankings which each site received for each criterion. As noted above, for some criteria there was greater variation than for others.

Once all of the sites had been reviewed, four distinct groups of sites emerged (see Figure 8.2).

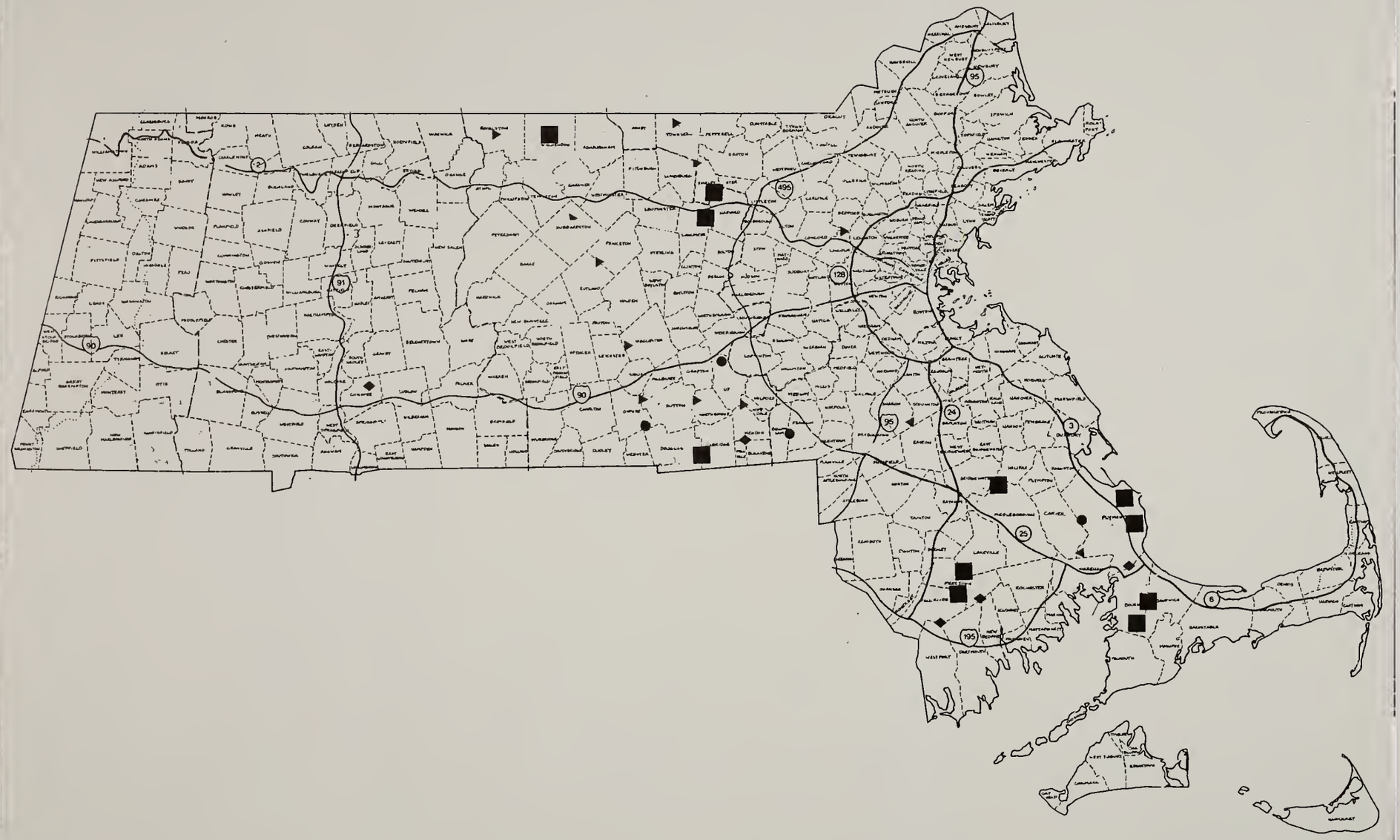
- Those sites which had reasonable characteristics with respect to all of the site criteria (11 locations). All of these sites ranked well on aeronautical and environmental features.

- Those sites which had reasonable characteristics with respect to all of the site criteria, with the exception that they would require the use of very large areas of parkland (4 locations). These four sites were all largely situated within State Forests which are in active recreational use.

- Those sites which did not meet a number of site criteria very well (5 locations). Of particular concern were the significant noise impacts to existing communities which would likely occur if these sites were developed for a SMA.

- Those sites which could not accommodate more than one 10,000 foot runway, and could thus not meet the airfield capacity needs of a second major airport (12 locations). These sites were initially included in the site search because it was not known if any large sites would be found, however, 20 sites greater than 3,000 acres in size were ultimately identified for the site inventory.

Figure 8.2
Inventory of Sites



■ Category 1 - Universe of Sites
● Category 1A - Park Sites
◆ Category 2 - Low Ranking Sites
▲ Category 3 - One 10,000 Runway

Note: All locations are approximate

0 20 miles

SECOND MAJOR AIRPORT SITING STUDY

RECOMMENDATIONS

The results of Part A of the study were presented by the Consultant Team to the MAC on November 27, 1990. The Commission voted to take the following action during Part B of the Siting Study.

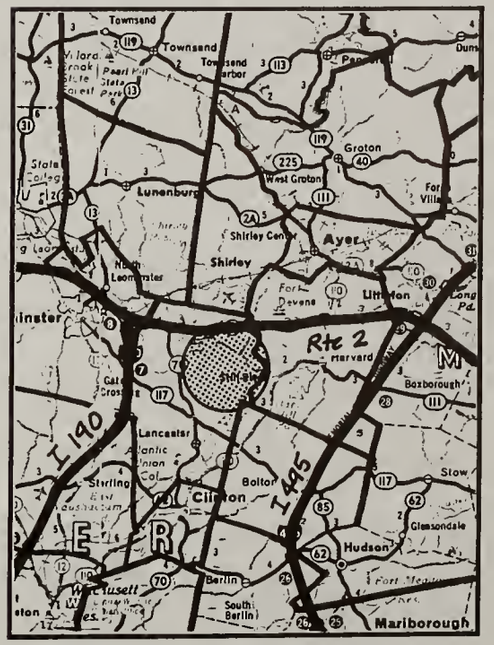
1. To eliminate from further investigation those sites which cannot accommodate adequate airfield capacity to serve as a SMA. 12 locations - Category 3 on Table 8.6.

2. To evaluate further those 11 locations which had reasonable characteristics relative to all of the site criteria - Category 1 on Table 8.6. From these 11 locations (see Figures 8.3-13) it is anticipated that a short list of possible sites will emerge.

3. To hold in reserve those sites which are primarily parkland (Category 1A) or which do not meet the site criteria very well (Category 2). It was recommended that these sites not be given further consideration during this study, but that they be re-evaluated at a later date if none of the Category 1 sites are deemed to be suitable for further investigation following the conclusion of this study.

Figure 8.3

Site A
Harvard / Lancaster
Shirley



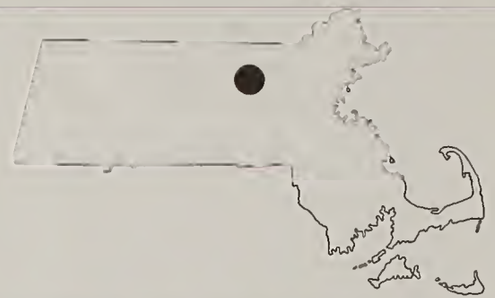
* Contours shown at 3 meter intervals.

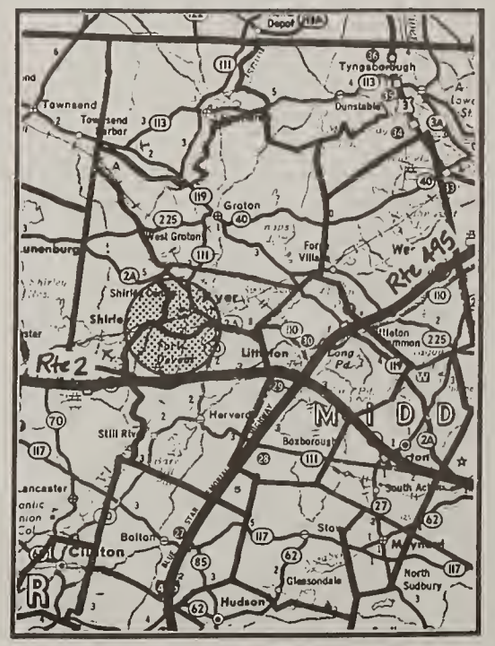
0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.4

Site B
Shirley / Harvard
Lancaster / Ayer





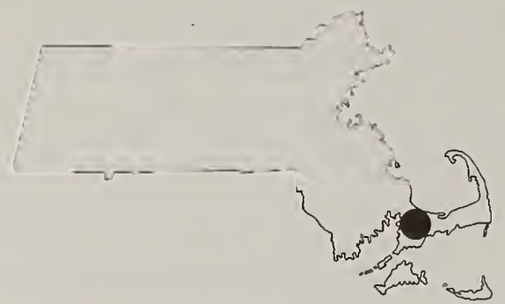
* Contours shown at 3 meter intervals.

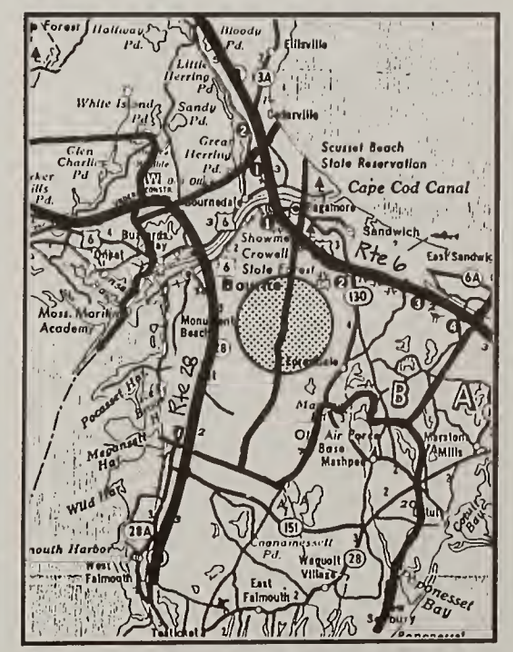
0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.5

Site D
Bourne / Sandwich





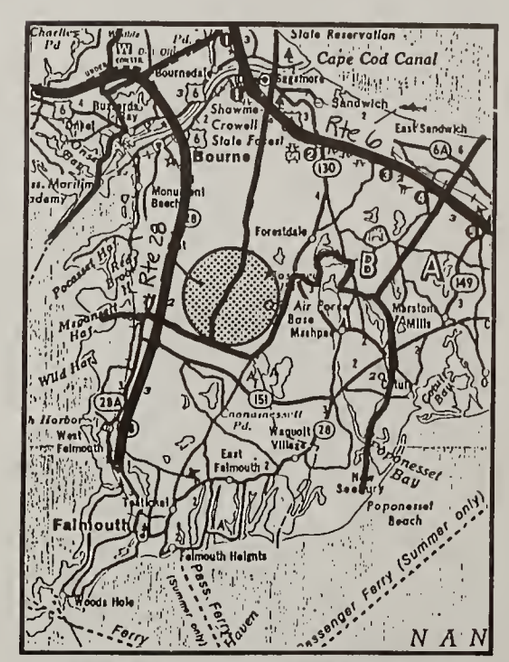
* Contours shown at 10 foot intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.6

Site D1
Bourne / Sandwich



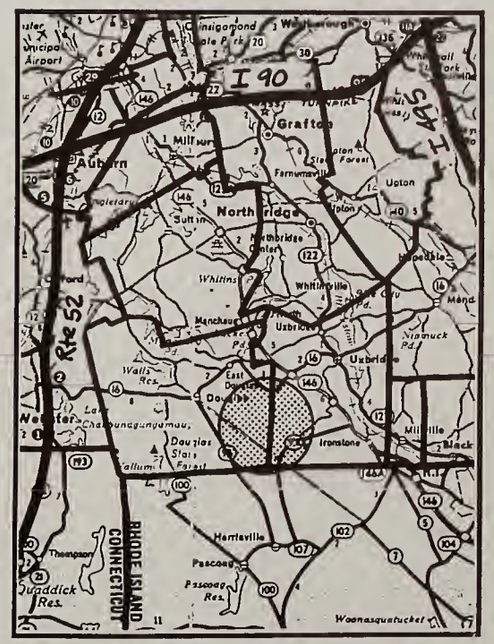
* Contours shown at 10 foot intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.7

Site G
Douglas / Uxbridge



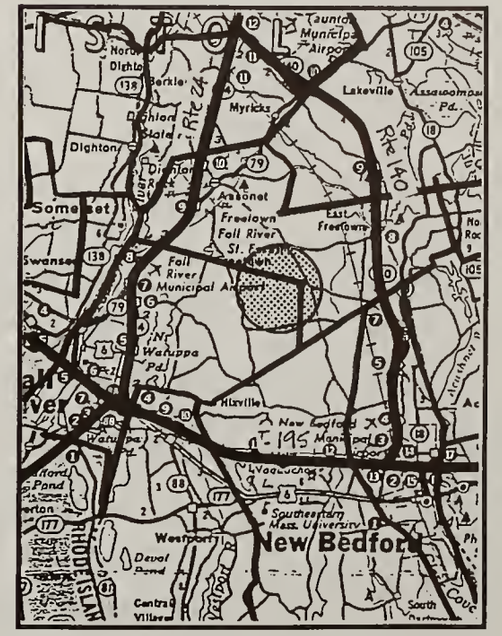
* Contours shown at 3 meter intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.8

Site H
Fall River / Freetown



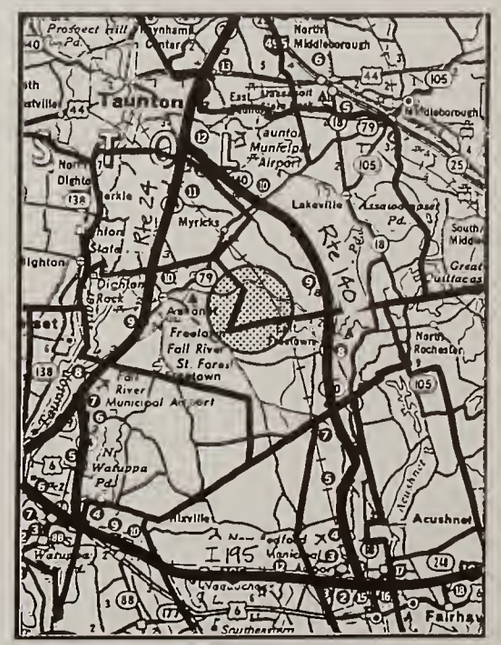
* Contours shown at 10 foot intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.9

Site H1
Freetown / Lakeville



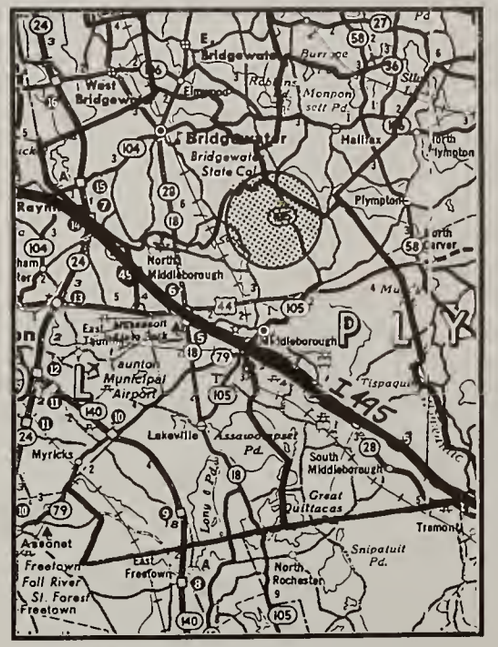
* Contours shown at 10 foot intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.10

Site M
Middleboro / Bridgewater / Halifax



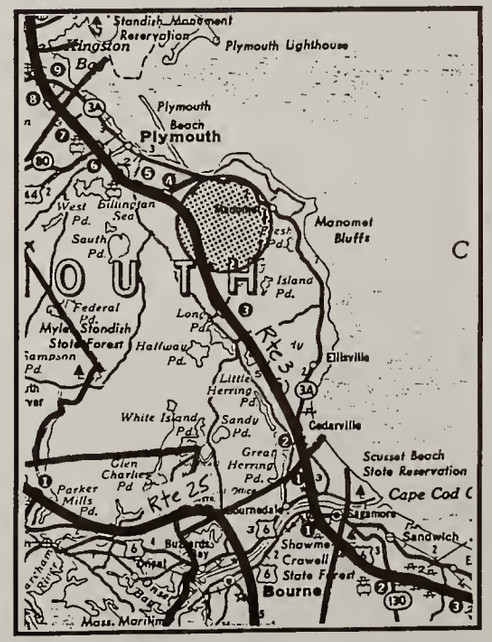
* Contours shown at 10 foot intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.11

Site P
Plymouth



* Contours shown at 10 foot intervals.

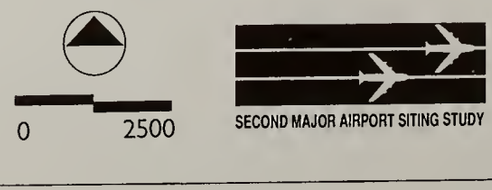
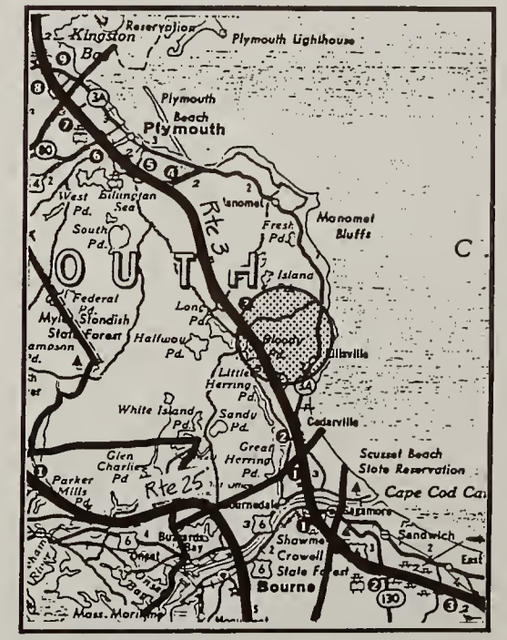


Figure 8.12

Site Q
Plymouth



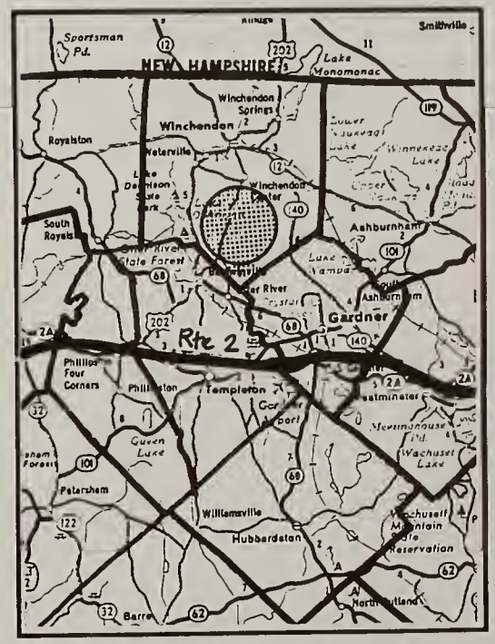
* Contours shown at 10 foot intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

Figure 8.13

Site BB
Winchendon



* Contours shown at 3 meter intervals.

0 2500

SECOND MAJOR AIRPORT SITING STUDY

9. PART B WORK PROGRAM

The work which will be undertaken during Part B of the Study is described below, and the schedule for the work is shown in Figure 9.1.

SCREENING OF THE UNIVERSE OF SITES

In order to develop a short list of sites, the 11 sites which have been determined to be possible SMA sites will be investigated in greater detail. Information on the sites will be collected from local, state, regional and federal sources. All of the communities in which the sites are located will be contacted, as will all of the relevant state and federal agencies and appropriate regional planning agencies. Selected private organizations such as watershed associates and Chambers of Commerce will also be contacted for information.

The site criteria to be evaluated during this site screening are:

1. Aeronautical features
2. Cost
3. Economic impacts
4. Environmental features
5. Land Use compatibility
6. Market capture
7. Site features
8. Transportation characteristics

Following the evaluation of the 11 sites, those sites which are determined to be potentially suitable for a SMA will be recommended as the Short List of Sites.

PREPARATION OF DETAILED SITE STUDIES FOR THE SHORT LIST OF SITES

A series of detailed site profiles will be prepared for those sites selected for the short list. The site profiles will include the following types of information.

- A comprehensive description of site conditions, noise impact contours, land use compatibility, passenger and cargo market areas, and economic impacts.
- A diagrammatic airport layout for each site showing runway configuration, ground access and areas for terminal, cargo and support facilities.
- An estimate of capital costs for each site based on land cost, infrastructure cost, airport site and building cost, and off-site roadway costs.

A preliminary finance strategy for a SMA, including financing options, consideration of potential federal funding, and identification of key finance strategy issues also will be developed during Part B.

ACTION PLAN

The Action Plan will have two primary components; identification of future actions needed to identify, secure and implement a Second Major Airport and; identification of the tools needed to by local communities to manage the growth and change which would occur as the result of the development of a Second Major Airport.

Among the issues to be addressed in the Action Plan are:

- Regulatory and environmental issues
- Institutional issues'
- Legislative initiatives and requirements
- Regional and local planning and growth management issues
- Site planning, design and construction issues

FINAL REPORT AND BROCHURE

A final report and an information brochure outlining the study and its findings and recommendations will be available for public distribution in April 1991.

PUBLIC MEETINGS AND BRIEFINGS

Following completion of the Study, MAC will hold a series of public meetings and briefings Boston and in the affected regions identified in the Short List of sites.

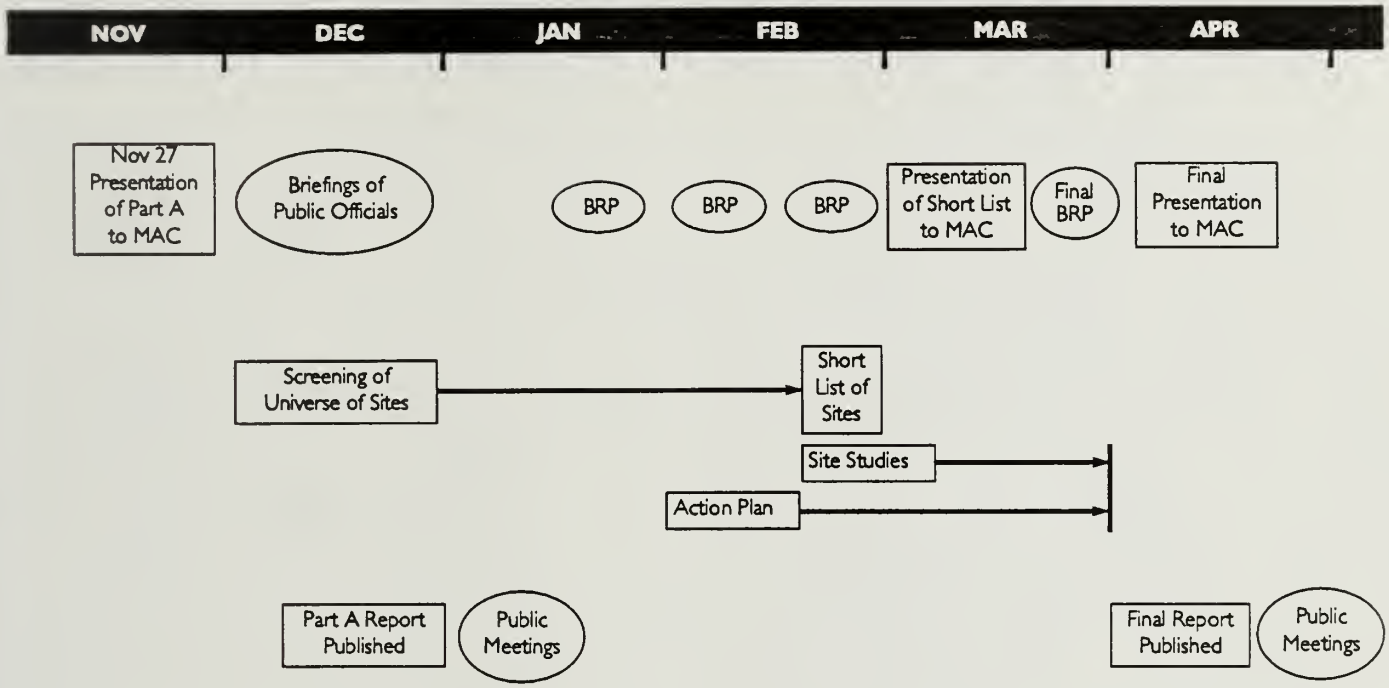


Figure 9.1

Second Major Airport Siting Study

PART B - WORK PROGRAM AND MEETING SCHEDULE

SECOND MAJOR AIRPORT SITING STUDY